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WYLE LABS HUNTSVILLE ALA  
CAPSIZING/SWAMPING ACCIDENT INVESTIGATIONS FOR 1976 SEASON. (U)  
SEP 77 J BOWMAN, B SMITH

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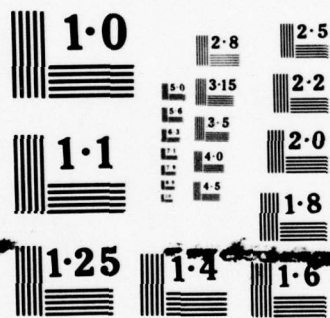
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CAPSIZING/SWAMPING ACCIDENT INVESTIGATIONS FOR 1976 SEASON

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13. Sponsoring Agency Name and Address U. S. Department of Transportation United States Coast Guard Office of Research and Development Washington, DC 25090	14. Sponsoring Agency Code USCG (G-DSA)	15. Supplementary Notes This report covers one year of a multi-year accident investigation program. U.S. Coast Guard Project Officer: Paul B. McMahan (G-DSA-2)
16. Abstract From several hundred boating accidents, 28 were selected for in-depth investigations. These in-depth investigations were performed to augment and supplement the Coast Guard's data base acquired from the nationwide Boating Accident Reports (BARs). Unlike the several thousand BARs received annually, the in-depths contain details of the entire accident scenario and are used to assist in establishing national programs of loading related accident prevention by boat design and education.  This report summarizes the criteria for selection of those accidents to be investigated, the investigation procedures, and the accident data obtained for the 28 in-depth investigations. Each individual accident report is presented as Appendices to the summary report. The accident reports present information concerning the weather, the involved boat and occupants, causal factors, boat capacities and loading/powering information, and occupant actions/reactions prior to, during, and after the actual accident event.		
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Abstract

ABSTRACT

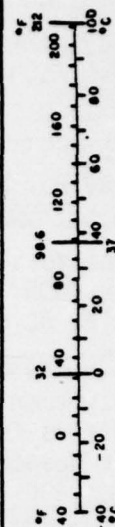
# METRIC CONVERSION FACTORS

## Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
<b>LENGTH</b>				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
<b>AREA</b>				
sq ft	square feet	0.09	square centimeters	cm <sup>2</sup>
sq yd	square yards	0.8	square meters	m <sup>2</sup>
sq mi	square miles	2.6	square kilometers	km <sup>2</sup>
acres	acres	0.4	hectares	ha
<b>MASS (weight)</b>				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
<b>VOLUME</b>				
teaspoon	teaspoons	5	milliliters	ml
fluid oz	fluid ounces	30	milliliters	ml
cup	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.96	liters	l
gal	gallons	3.8	liters	l
cu ft	cubic feet	0.03	cubic meters	m <sup>3</sup>
cu yd	cubic yards	0.76	cubic meters	m <sup>3</sup>
<b>TEMPERATURE (exact)</b>				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

\* 1 in. = 2.54 cm (exact)

Symbol	When You Know	Multiply by	To Find	Symbol
<b>LENGTH</b>				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
<b>AREA</b>				
cm <sup>2</sup>	square centimeters	0.16	square inches	in <sup>2</sup>
m <sup>2</sup>	square meters	1.2	square yards	yd <sup>2</sup>
km <sup>2</sup>	square kilometers	0.4	square miles	mi <sup>2</sup>
ha	hectares (10,000 m <sup>2</sup> )	2.5	acres	ac
<b>MASS (weight)</b>				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	sh
<b>VOLUME</b>				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m <sup>3</sup>	cubic meters	36	cubic feet	ft <sup>3</sup>
m <sup>3</sup>	cubic meters	1.3	cubic yards	yd <sup>3</sup>
<b>TEMPERATURE (exact)</b>				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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APPENDICES A THROUGH BB - Individual Accident Investigation Reports

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## CAPSIZING/SWAMPING ACCIDENT INVESTIGATIONS FOR 1976 SEASON

### 1.0 INTRODUCTION

As part of the Coast Guard's responsibilities to insure the design safety of recreational boats and therefore to provide inputs to the prevention of loading related accidents, an in-depth accident investigation program was initiated. These in-depth accident investigations were conducted to supplement the Boating Accident Reports which result from the Coast Guard accident reporting system nationwide. These accident reports (BARs) do not contain detailed analysis of the actual accident events. The in-depth investigations, therefore, provide timely and relevant data to be used by Coast Guard Office of Boating Safety and Office of Research and Development in the development and implementation of national plans to reduce the number of deaths and injuries resulting from loading related accidents - capsizings and swampings specifically - which claim the majority of the over 1500 accident fatalities yearly.

This report documents and summarizes the accident investigation effort started in 1976 and ending in May 1977. The accidents investigated in this task consisted of capsizings and swampings. A brief summary of each of the 28 accidents is given along with a table showing pertinent accident information (see Table 1). (Also, see Section 4.1 for a concise narrative version of Table 1.) The information obtained from these investigations is to be used as input into a major task relating to safe loading (as well as being used as input into other ongoing Coast Guard projects).

Each of the 28 accidents is presented as an Appendix to this report. Each of these individual accident reports contains the following sections with applicable information:

- 1.0 Boat Occupant Data
- 2.0 Environment
- 3.0 Narrative Description of Accident
- 4.0 Vessel Data
- 5.0 Psychological and Human Factors
- 6.0 Probable Cause of Accident
- 7.0 Dynamics/Analysis of the Accident.

This report presents the methodology used to select accidents for investigations and the procedures used to obtain the desired information, as well as the detail results of the investigations.

## 2.0 ACCIDENTS RECEIVED FOR CONSIDERATION

Candidate accidents for investigation were received via a special WATS line reporting system. Coast Guard Headquarters directed local Coast Guard groups to call a specified telephone number and report accidents related to the study being performed. The telephone number was that of the special WATS line installed at Wyle for the purpose of receiving these accident alerts.

Details of this system and the accidents received via this system can be found in WATS Accidents Reported in 1975 - A Summary of the Accident ALERT Reports, by A. Shikoh, and J. Bowman, prepared by Wyle Laboratories for the Coast Guard.

In summary, there were 197 capsizing/swamping accidents reported to Wyle via the WATS line for the 1976 season. In addition to these 197, some capsizing/swampings from 1977 were investigated under this task. From these accidents, 28 were selected for in-depth investigations as described in the following sections.

### 3.0 SCREENING OF ACCIDENTS

#### 3.1 Screening Criteria

From all of the capsizing/swamping accidents received, a relatively small number had to be selected for investigation. Several criteria were established as guidelines for selection of accidents to be investigated. These guidelines were based on the anticipated use of the information obtained from the investigations. Since these investigations were to be used as input for the Safe Loading Standard evaluation, boats which were regulated by this standard were of prime consideration for investigations. Other characteristics that were considered included:

- Capsizing/Swamping - primary accident cause
- Gross Overloading - assessed low priority
- Boat - available for inspection
- Survivors/Witnesses - available for questioning
- Geographic Location - optimize transportation logistics, cost via multiple investigations per trip.

#### 3.2 Screening Procedure

Once Wyle received an accident report, it took several calls to screen the accident and make an appointment for a visit and interview. Since timely reporting of accidents was essential, the Coast Guard groups reporting the accidents would report them without waiting to obtain information other than that first received. In screening the accidents Wyle would call back the reporting station and obtain any additional information which they may have obtained. Survivors and witnesses were then called and asked about the accident. If it was felt that the accident warranted investigating, an appointment was made for a personal interview and boat inspection.

#### 4.0 DATA ACQUIRED THROUGH INVESTIGATION

The information that is contained in each of the seven sections of an accident report is as follows:

- Section 1.0 Boat Occupant Data

This section gives the following information for each of the occupants on board at the time of the accident:

Sex	Boating Experience
Age	Formal Boating Instruction
Weight	PFD Used
Swimming Ability	

In addition to the aforementioned information, a brief narrative of the operator's and passengers' backgrounds is generally included.

- Section 2.0 Environment

This section gives a brief description of the environment at the time of the accident. Generally, the reporting Coast Guard Station or local weather service was called to obtain local conditions at the time of the accident.

- Section 3.0 Narrative of the Accident

This section is subdivided into four section: Pre-Accident, Accident, Post Accident, and Time Sequence of Accident Events.

The Pre-Accident section describes the operator's and other occupants' activities prior to the accident. It attempts to establish the operator's level of fatigue by discussing his activities for approximately 24 hours before the accident. Fueling and boat preparation procedures are also discussed. All activities up until accident initiation are included in this section.

The subsection entitled Accident discusses the actual accident scenario. Boat, occupant, and water actions are discussed describing what attitude the boat is taking, why it is taking that attitude (flooding, capsizing, etc.), and what the occupants are doing as the accident is taking place.

The Post Accident section discusses persons' and boat conditions just after the accident and relates rescue operations whether self-rescue by the occupants or rescue by another vessel.

The Time Sequence of Accident Events section presents the activity of the occupants prior, during, and after the accident in a chronological sequence.

- Section 4.0 Vessel Data

This section gives a description of the boat involved in the accident. Capacity plate values are given when the boat has a capacity plate. Any modifications to the boat hull are also described.

- Section 5.0 Psychological and Human Factors

This section deals with qualities of the accident that relate to the psychological attitudes or human decisions/factors of the occupant. Any past accident history of an operator may be designated here. The fact that the operator may be on an ego trip, trying to perform extraordinary feats with his boat, or just poor judgment in the boat handling is pointed out in this section, as is any suspected use of drugs or alcohol.

- Section 6.0 Probable Cause of Accident

The precise cause of the accident is summarized here. If the cause is an opinion of the investigator formulated from interviewing, it is noted as an opinion.

- Section 7.0 Dynamics/Analysis of the Accident

This section deals with the major events of the accident itself. Each event of the occupant action, boat motion, or water action on the boat or occupants is given in chronological order.

Each investigation was written as a separate report and submitted for USCG review. Section 5.0 of this report gives a brief summary of the 28 accidents investigated for this effort.

#### 4.1 Summary of the Information Obtained in the Accident Investigations

Of the 28 boats involved in the investigated accidents, 15 were of tri-hull configuration, 10 were semi-V, and three flatbottomed. Three-quarters of the hulls were fiberglass, with aluminum or wood being the material used for the remaining quarter. These boats were predominantly open boat construction; only five were decked. Seventeen of the boats were less than 16 ft (4.9 m) in length, while 11 were equal to or greater than that number. In 17 cases, the beam width was equal to or greater than five feet (1.5 m); this measurement was unknown for seven of the boats.

All of the craft were powered by outboard motors and had displayed horsepower capacities ranging from 7.5-300 hp. Of these, a horsepower rating of less than 100 occurred 13 times, while ratings for eight of the boats were unknown. The actual horsepower of the motors used ranged from 6-270 hp, with less than 100 hp occurring in 23 cases. Three out of the 28 involved boats were found to be "over-powered." The known speeds of the boats at the time of the accident were less than 10 mph (16 kph) in 11 instances, equal to or greater than that figure in four cases, while in one case the speed of movement of the boat was unknown. Ten boats were drifting just prior to the accident; two were anchored.

The known displayed persons capacities ranged from 300-1200 lb (136-544 kg), with an "equal to or greater than" 600 lb (272 kg) capacity occurring 10 times and less than 600 lb (272 kg) occurring six times. In 12 instances the displayed persons capacity was unknown. Actual persons' weights on board at the time of the accident were 145-895 lb (66-406 kg), with less than 600 lb (272 kg) occurring 21 times and equal to or greater than 600 lb (272 kg) occurring seven times. Three out of the 28 boats were found to be "overloaded."

The total number of persons on board for all 28 accidents was 85. The two most common number of persons aboard any one boat were three (nine cases) and two (eight cases). Of these 85 persons, seven had had formal boating instruction. The operators of the boats ranged in age from 11-87 and had boating experience of from 10 to greater than 500 hrs, with greater than 500 hrs occurring more frequently (10 instances).

The mechanism of capsizing was most often from water over the bow (12 instances), with water over the transom occurring in nine cases and water over the side six times. Of the 28 accidents investigated, there was one fall overboard which was the initiator of the capsizing.

Four fatalities occurred among the 28 accidents; there were no more than one per accident. PFDs were being worn before the accident by 15 persons; after the mishap by a known 45 persons.

The final attitude of the boat was most often inverted and level (12 cases). Inverted, bow high occurred six times; upright and level five times; upright, bow high three times; while two boats sank.

INVESTIGATION NUMBER	HULL TYPE	BOW CONSTRUCTION	LENGTH OVERALL (FT/METERS)	MAXIMUM BEAM (FT/METERS)	HULL MATERIAL	TYPE POWER	DISPLAYED HORSEPOWER	HORSEPOWER ON BOARD	DISPLAYED PERSONS CAPACITY (LB/KG)	PERSONS ON BOARD (LB/KG)
76-01	Semi-V	Open	15.00/4.57	-	Aluminum	Outboard	-	35	-	425/192.77
76-02	Semi-V	Open	12.16/3.70	4.33/1.31	Aluminum	Outboard	15	7.5	345/156.48	410/185.97
76-03	Tri-Hull	Open	15.16/4.62	5.75/1.75	Fiberglass	Outboard	85	65	-	450/204.11
76-04	Flatbottom	Open	12.08/3.68	2.58/0.78	Aluminum	Outboard	-	9.9	-	145/ 65.77
76-05	Semi-V	Open	12.16/3.70	4.00/1.21	Aluminum	Outboard	12	7.5/2	-	330/149.68
76-06	Tri-Hull	Open	15.50/4.72	5.54/1.68	Fiberglass	Outboard	85	50	330/149.68	370/167.82
76-07	Tri-Hull	Open	15.00/4.57	-	Fiberglass	Outboard	75	55	750/340.19	673/305.26
76-08	Semi-V	Open	12.08/3.68	4.12/1.25	Fiberglass	Outboard	10	6	405/183.70	165/ 74.81
76-09	Tri-Hull	Open	14.16/4.31	5.14/1.56	Fiberglass	Outboard	35	40	600/272.15	296/134.26
76-10	Flatbottom	Open	13.83/4.21	4.54/1.38	Aluminum	Outboard	20	15	540/244.93	393/178.26
76-11	Semi-V	Open	17.91/5.45	7.08/2.15	Fiberglass	Outboard	150	135	1200/544.31	845/383.28
76-12	Semi-V	Decked	17.16/5.23	7.00/2.13	Wood	Outboard	100	80	1200/544.31	656/297.55
76-13	Tri-Hull	Open	15.50/4.72	6.41/1.95	Fiberglass	Outboard	95	55	900/408.23	585/265.35
76-14	Semi-V	Open	23.25/7.08	8.00/2.43	Fiberglass	Outboard	300	135/2	1200/544.31	463/210.01
76-15	Tri-Hull	Open	16.25/4.95	7.25/2.20	Fiberglass	Outboard	140	65	1050/476.27	230/104.32
76-16	Tri-Hull	Open	14.50/4.41	5.50/1.67	Fiberglass	Outboard	65	65	600/272.15	440/199.58
76-17	Tri-Hull	Open	15.08/4.59	5.58/1.70	Fiberglass	Outboard	-	25	-	850/385.55
76-18	Flatbottom	Open	12.00/3.65	3.83/1.16	Aluminum	Outboard	7.5	7	300/136.07	395/179.16
76-19	Tri-Hull	Open	13.50/4.11	5.54/1.68	Fiberglass	Outboard	60	50	555/251.74	330/149.68
76-20	Tri-Hull	Open	18.00/5.48	-	Fiberglass	Outboard	-	50	-	310/140.61
76-21	Tri-Hull	Open	16.75/5.10	6.83/2.08	Fiberglass	Outboard	125	85	900/408.23	200/ 90.71
76-22	Tri-Hull	Decked	16.00/4.87	-	Fiberglass	Outboard	-	115	-	455/206.38
76-23	Semi-V	Decked	16.00/4.87	6.43/1.95	Fiberglass	Outboard	110	115	600/272.15	350/158.75
76-24	Tri-Hull	Open	15.50/4.72	-	Fiberglass	Outboard	-	40	-	655/297.10
76-25	Semi-V	Decked	16.50/5.02	7.00/2.13	Fiberglass	Outboard	-	55	-	565/256.27
76-26	Tri-Hull	Open	15.16/4.62	5.75/1.75	Fiberglass	Outboard	80	65	-	825/374.21
76-27	Tri-Hull	Open	18.00/5.48	-	Fiberglass	Outboard	150	135	-	895/405.96
76-28	Semi-V	Decked	16.00/4.87	-	Fiberglass	Outboard	-	85	-	515/233.60

- (1) 1 - Water over bow  
2 - Water over transom  
3 - Water over side  
4 - Reduced freeboard due to load distribution  
5 - Capsize by single wave

- (2) IL - Inverted and level  
IB - Inverted, bow high  
UL - Upright and level  
UB - Upright, bow high  
S - Sunk

DISPLAYED PERSONS CAPACITY (LB/KG)	PERSONS ON BOARD (LB/KG)	DISPLAYED MAXIMUM WT. CAPACITY (LB/KG)	TOTAL WEIGHT ON BOARD (LB/KG)	ESTIMATED SPEED (AT TIME OF ACCIDENT) (MPH/KPH)	PERSONS ON BOARD (NO.)	PERSONS WEARING PFDS BEFORE ACCIDENT (NO.)	PERSONS WEARING PFDS AFTER ACCIDENT (NO.)	NO. PERSONS W/FORMAL BOATING INSTRUCTION	OPERATOR'S AGE	OPERATOR'S BOATING EXPERIENCE (HRS)	MECHANISM OF CAPSIZE (1)	FATALITIES (NO.)	FINAL ATTITUDE OF BOAT (2)
-	425/192.77	-	-	Drifting	3	3	3	1	16	500	3	0	S
345/156.48	410/185.97	545/ 247.20	529/239.95	10/16	2	0	2	0	41	>500	1	0	IL
-	450/204.11	1150/ 521.63	775/351.53	Drifting	3	0	1	0	26	500	1	0	IB
-	145/ 65.77	-	220/ 99.79	3/ 4.82	1	0	0	0	41	50	3	0	UB
-	330/149.68	557/ 252.65	488/221.35	3/ 4.82	2	0	0	0	38	>500	3	1	IB
330/149.68	370/167.82	875/ 396.89	635/288.03	Anchored	2	0	0	0	59	100	1	0	UB
750/340.19	673/305.26	1200/ 544.31	1005/455.86	Drifting	5	5	5	0	27	300	3	0	UL
405/183.70	165/ 74.84	545/ 247.20	280/127.00	7/11.26	1	0	0	0	69	>500	3	0	IL
600/272.15	296/134.26	750/ 340.19	527/239.04	36/57.93	2	0	0	0	24	>200	Fall Overboard	0	UL
540/244.93	393/178.26	740/ 335.65	533/241.76	5/ 8.04	3	0	1	0	11	300	1	0	IL
1200/544.31	845/383.28	1500/ 680.38	1270/576.06	5/ 8.04	6	4	4	1	35	100	1	1	IL
1200/544.31	656/297.55	1730/ 784.71	1059/480.35	Drifting	4	0	4	0	64	<100	2	1	IB
900/408.23	585/265.35	1775/ 805.12	880/399.16	7/11.26	3	1	1	0	57	>500	1	1	IL
1200/544.31	463/210.01	3185/1444.69	1203/545.67	Drifting	3	0	3	1	51	>500	2	0	IB
1050/476.27	230/104.32	1800/ 816.46	580/263.08	Drifting	1	0	0	0	62	>500	1	0	UL
600/272.15	440/199.58	1100/ 498.95	705/319.78	Drifting	3	0	3	0	19	500	2	0	IL
-	850/385.55	-	1250/566.99	5/ 8.04	6	0	4	0	27	>200	1	0	IL
300/136.07	395/179.16	440/ 199.58	440/199.58	Drifting	2	2	2	0	40	>200	2	0	IL
555/251.74	330/149.68	940/ 426.37	605/274.42	Drifting	2	0	2	0	27	>500	1	0	IB
-	310/140.61	-	720/326.58	30/48.28	2	0	2	0	40	<100	1	0	IL
900/408.23	200/ 90.71	1350/ 612.34	707/320.68	Drifting	1	0	0	0	45	<100	3	0	UL
-	455/206.38	-	900/408.23	5/ 8.04	3	0	3	0	21	400	2	0	IL
600/272.15	350/158.75	-	697/316.15	Anchored	2	0	0	0	29	>500	2	0	IB
-	655/297.10	-	992/449.96	3/ 4.82	4	0	0	0	32	10	2	0	S
-	565/256.27	-	873/395.98	10/16.00	3	0	0	2	87	>500	2	0	IL
-	825/374.21	-	1068/484.43	7/11.26	8	0	Unknown	2	57	>500	1	0	IL
-	895/405.96	-	1358/615.97	5/ 8.04	5	0	5	0	21	< 50	1	0	UL
-	515/233.60	-	935/424.10	0/ 0.00	3	0	0	0	24	>100	2	0	UB

TABLE 1. SUMMARY OF 1976  
CAPSIZING/SWAMPING ACCIDENTS

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## 5.0 SUMMARY OF IN-DEPTH INVESTIGATION

Following are brief narrative summaries taken from the 28 accidents that have been investigated for the 1976 Capsizing/Swamping Accident Investigation task.

76-01 At approximately 0930 three 16 year old girls and one 11 year old boy left their waterfront dock in a 15 ft (4.6 m) Larson aluminum open boat powered by a 35 hp Evinrude outboard motor. They traveled up the canal which led from their dock to Lake St. Clair, Michigan. When they reached the entrance to the lake it was rougher than they had expected. At this time they all donned AK-1 type PFDs. They proceeded to a nearby submerged sandbar and were planning on going swimming. One of the girls jumped out of the boat into about 3 ft (0.9 m) of water. At this time, waves began to break into the boat filling it with water and causing it to sink. All the occupants walked to shore except the 11 year old who had to swim for periods when the water was too deep. The primary cause of this accident is an error in judgment on the part of the operator - attempting to anchor a small boat in a bar area where waves were cresting and breaking.

76-02 This accident involved a 12 ft 2 in. (3.7 m) open aluminum semi-V fishing boat powered by a 7.5 hp outboard motor. The type of accident was a swamping and subsequent capsizing, resulting in no injuries or fatalities.

At about 1400 on a Saturday, two men were drift fishing inside an inlet along the New Jersey coast. There was considerable traffic in the area, including other boats drifting and larger craft transiting the inlet. The men had been fishing with the flooding current without difficulty. After the current changed and began to ebb, however, the water became turbulent, but the men stayed to fish awhile longer. While headed in against the current, they encountered two successive waves, thought to be wakes from passing boats. The boat did not recover from the first wave, and plowed into the second, which nearly filled it. The operator then shut down the engine to minimize damage to it, and both men exited over the side while holding their buoyant cushions as the boat slowly capsized. They held onto the cushions and the overturned boat until rescued shortly afterwards by a passing Coast Guard boat.

Use of a boat not suited for predictable rough water conditions is considered the major causative factor. Contributing factors probably include operator inattention, poor load distribution, operator inexperience with varying inlet conditions, social pressure, and wakes from other boats.

76-03 This accident involved a 15 ft 2 in. (4.6 m) bowrider runabout powered by a 65 hp outboard motor. The type of accident was a swamping with subsequent capsizing, resulting in no injuries or fatalities.

Three men in their twenties, co-workers on their day off, went out fishing for the day on Long Island Sound. The owner/operator was rather inexperienced. He had purchased the boat three months earlier, and this was his first trip to the Sound in it. Also, he was not aware that water could accumulate in the inner hull.

After staying close to shore during the morning on account of fog, the operator followed a party fishing boat about 8 (statute) miles (12.9 km) to The Race, an area at which tide rips are almost always present. He followed the normal practice of fishing while drifting toward the rip and then powering ahead against the ebbing current. On one drift, he delayed starting up until into the rough water, possibly due to overdependence on the lead of the party boat. Before he shifted the motor into gear, the boat was quickly swamped over the bow. As the occupants began to move about, the boat capsized. Only one was able to grab a PFD, but all three managed to climb onto the overturned boat. They were rescued by another small boat within a few minutes. The boat was recovered later by the Coast Guard.

This accident most likely occurred as a result of reduced freeboard due to undetected water in the inner hull and delay on the part of the operator in moving away from the tide rip, due to some combination of inexperience, inattention, carelessness, and overdependence on the lead of a substantially more seaworthy party fishing boat.

76-04 This accident involved a 12 ft 1 in. (3.7 m) flatbottom johnboat powered by a 9.9 hp outboard motor. The type of accident was a swamping with a subsequent fall overboard, resulting in no injuries or fatalities.

At approximately 0900 on May 2, 1976, a man, his wife, young son, and daughter arrived at a launch ramp located in southeastern Louisiana for a picnic/fishing outing. The boat was launched in a small canal which ran into a large bayou approximately 1/4 mi. (0.4 km) from the launch ramp. The family spent the day fishing and picnicking, with the father (operator) alternately taking the boy and girl out to the bayou to fish. At approximately 1545, the family started preparing to return home. During the day, debris had collected on the boat bottom and lower motor unit from running the boat through marsh areas. The operator took the boat out and started running it up and down the center of the bayou to wash off the

debris. At approximately 1600, he was headed down the bayou toward the canal that led to the launch ramp at approximately 10 mph (16.1 kph). He noticed a large commercial skiff coming up behind him at a speed of 20-25 mph (32.2-40.2 kph). As the skiff overtook him, he noticed that the skiff stern wake was 1 ft to 1-1/2 ft (0.3 to 0.5 m) high. He slowed his boat to idle speed and headed the bow of his boat toward the wake at a 45 degree angle. As the bow rode up on the first wave, the boat rolled quickly to starboard, throwing the operator out over the starboard stern. The boat rapidly filled with water and sank stern down with the forward half of the boat remaining above water. The operator swam back to the boat and pulled it approximately 50 ft (15.2 m) to a wooden picket area close to shore. The skiff returned and the operator of the swamped boat was taken aboard. The swamped boat was partially evacuated of water and towed back to the launch ramp by the skiff.

The major factors in causing this accident are inexperience on the part of the operator. He exercised poor judgment in trying to negotiate the large wake. He should have headed bow on into the waves. Also to be considered is the failure of the skiff operator to maintain adequate clearance and minimum wake speed when overtaking a small vessel.

- 76-05 - This accident involved a 12 ft 2 in. (3.7 m) semi-V aluminum boat powered by a 7.5 hp outboard motor. The type of accident was a capsizing resulting in one fatality and one exposure resulting in hypothermia.

At approximately 1800 on May 9, 1976, two brothers launched the involved boat, which had been borrowed from a friend, at a launch ramp located in northwestern Michigan along the shore of Lake Superior. The two were trolling along the edge of a reef approximately 1/2 mi. (0.8 km) from shore in 50 ft (15.2 m) of water. The water temperature was approximately 38°F (3.3°C). Between the time they launched the boat and the accident occurred, the two men had drunk three beers each. The passenger (survivor) had also taken three muscle relaxants, two prior to leaving home and one 10 to 15 minutes before the accident. At approximately 2100, the operator stood up, lost his balance, and fell on the passenger. The boat capsized, throwing both men into the water. The men tried to flip the boat, but were unsuccessful. The passenger began swimming to shore at approximately 2125. The operator was last seen drifting away from the boat. The passenger reached shore at approximately 2200 and ran to the nearest town, reaching there at 0100. He suffered from hypothermia. The operator is missing and presumed dead. The jacket type PFD that the operator had with him is also missing.

There were two major factors in causing this accident. The operator stood up, causing a shift in weight. This shift probably caused him to lose his balance. Also, the two men had been drinking, which may have contributed to the operator's inability to maintain his balance when he stood up.

76-06 This accident involved a 15 ft 6 in. (4.7 m) open runabout powered by a 50 hp outboard motor. The type of accident was a swamping of the boat, resulting in no injuries or fatalities.

At approximately 1000 on August 7, 1976, two men reached the shelter of a Coast Guard station located in southeastern Louisiana after aborting a planned fishing trip due to an isolated thunderstorm. The involved boat was maneuvered under a raised helipad, where another small pleasure boat (approximately 25 ft [7.6 m]) with occupants was tied to a support column waiting out the storm. The bow of the involved boat was tied with a line to the stern of the other boat. After being under the shelter for approximately 10 minutes, a third pleasure boat (approximately 18 ft [5.5 m]) came under the shelter to wait out the storm. The operator of the 18 ft (5.5 m) boat threw a bow line to the 25 ft (7.6 m) boat. The line extended from the bow of the 18 ft (5.5 m) boat across the bow of the involved boat and was secured to the stern of the 25 ft (7.6 m) boat. Three to four ft (0.9 m to 1.2 m) waves existed under the helipad. The line between the 18 ft (5.5 m) and 25 ft (7.6 m) boat became tight which prevented the bow of the involved boat to rise with the waves. Subsequently, after the line became tight, the waves broke over the bow of the involved boat until it was flooded. The boat sank stern first with approximately 3 ft (0.9 m) of the bow section remaining above waves. As the boat flooded, the two occupants jumped over the side and swam to the 25 ft (7.6 m) boat approximately 15 ft (4.6 m) away. They were taken aboard the 25 ft (7.6 m) boat and transported a few yards away to a ladder where they climbed to safety. The involved boat was retrieved by the Coast Guard a few hours after the accident.

The major factors in causing this accident were: 1) that the operator was not aware of the limitations of his boat due to his inexperience, and 2) restriction of the vertical movement of the bow by a line across the bow section.

76-07 At approximately 1800, three women and two men were cruising in a 15 ft (4.6 m) fiberglass boat powered by a 55 hp Chrysler outboard motor. They were cruising at about 5 knots, running parallel to the shore and the oncoming waves. The operator of the boat was sitting on the back of the operator's seat, holding

onto the steering wheel. When the operator let go of the steering wheel to light a cigarette, he lost his balance and fell overboard. None of the other occupants knew how to operate the boat, but one of them managed to head the boat toward shore and then turn the motor off. The boat was quite near the shore and soon drifted into the breaking surf. The operator, who had fallen overboard was walking toward the boat, as the water was only chest deep. Before he could reach the boat, waves broke into the boat, causing it to swamp. All the other occupants then jumped out of the boat into knee-deep water. The occupants then dewatered the boat, using a bucket they had with them, headed the boat into the waves, pushed it out, and climbed aboard. The engine stopped after starting, and the boat was again swamped and beached by the breaking waves. The Coast Guard was notified at this time and they came and pulled the boat off the beach and towed it to the Coast Guard station. There were no injuries, and all occupants were wearing PFDs.

There were a combination of accidents involved in this accident scenario. The first was a fall overboard caused by one or more (probably a combination) of poor helmstation design (causing the operator to sit on top of the back of the seat to see over the windshield); inattentiveness on the part of the operator; and loss of equilibrium caused by wave motion and having drunk several beers.

76-08 At approximately 0800 on July 13, 1976, one man set out in his 12 ft (3.7 m) fiberglass Sears Gamefisher on a fishing/cruising trip. His home and place of launch of the boat was on the water in an area protected by offshore islands. He trolled along the inland side of the islands, specifically Shackleford Banks off the coast of North Carolina. When he reached the end of the banks, he decided to go to the ocean side of the banks for the return trip to his home. He stopped fishing, went into the ocean, and proceeded back in the direction toward his house. As he proceeded along the ocean side of the banks, the oncoming swells from the ocean began to get larger, reaching a height of 3 to 5 ft (0.9 to 1.5 m). As he proceeded along the banks, a wave would occasionally crest and break just offshore. The operator allowed his boat to get too close to shore, and one of the breakers capsized his boat. He managed to right the boat and swim with it to shore. After he beached the boat, he walked for several miles to phone for help, and then returned to his boat. The Coast Guard arrived on the scene shortly and had the operator taken to the hospital, because he appeared to be totally exhausted. The boat was towed to the Coast Guard Station, and the operator was examined and released from the hospital.

This accident was caused primarily by operating a small boat in an area that was known to have large breaking waves. Operating the boat broadside to the waves was also a major contributing factor. Poor judgment on the part of the operator in attempting to operate his boat in this area, resulted in the capsizing of his boat.

76-09 This accident involved a 14 ft 2 in. (4.3 m) tri-hull bass boat with stick steering powered by a 40 hp motor. The type of accident was a fall overboard of the two occupants aboard, resulting in serious leg injuries to the operator.

At approximately 0930 on August 22, 1976, a man and his wife set out on a fishing trip from a launch ramp located near Charlestown, N. C. After getting underway, the couple played out their fishing lines behind the boat to free the reels that had become entangled during storage. After freeing the reels, the lines were wound in, and the operator applied full throttle accelerating to approximately 36 mph (57.9 kph). Shortly after obtaining full speed, something happened to cause the boat to turn sharply to starboard, throwing the occupants out of the boat over the port side. The operator reached over the starboard side and turned off the ignition which stopped the motor. The operator boarded the boat and noticed that his leg had been badly cut by the prop when he was thrown out of the boat. He helped his wife aboard, and she restarted the boat and drove it back to the launch ramp. The operator was hospitalized within an hour after the accident. The passenger was not injured.

Inexperience with stick steering on the part of the operator is certainly considered a contributing factor. Also, there was a material failure. If the plastic ball on top of the control stick had come off in the operator's hand, the stick would have quickly gone forward, which would have put the boat in a sharp right turn.

76-10 This accident involved a 13 ft 10 in. (4.2 m) flatbottom aluminum johnboat powered by a 15 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1450 on August 21, 1976, an adult male and two 11 year old boys set out on a fishing trip from a private dock located on the Ogeechee River near Savannah, Georgia. The operator of the boat was the 11 year old son of the boat owner. The passengers were an uncle and a cousin. The party traveled approximately one mile (1.6 km) down the river at a speed of approximately 15 mph (24 kph). The boat was slowed to idle speed, and the occupants started preparing their

fishing equipment for trolling. Before the fishing lines were cast out, a large commercial trawler was observed coming up the river at approximately 20 mph (32 kph). As the trawler passed, the operator of the involved boat noticed that the wake was very high and turned the bow of his boat into the wake to avoid being swamped. The boat rode over the wake without taking on any water. After the boat was inside the wake, the operator decided to go back through the wake to a fishing area near the shore. The bow rode up over the first wave, then sliced bow first into the second wave, completely swamping the boat. The 11 year old passenger panicked, stood up, put his foot on the port gunwale, and jumped overboard and swam approximately 50 ft (15.2 m) to shore. When he jumped overboard, his weight on the port side caused the boat to capsize, dumping the operator and adult passenger over the port side.

The operator and adult passenger stayed with the capsized boat until rescued by relatives who were in a small boat nearby. The involved boat was righted and towed back to the private dock.

The major factors in causing this accident are the poor judgment on the part of the operator to avoid the wake and his decision to go back out through the wake once safely inside, and unsafe operating procedures on the part of the commercial vessel operator created the conditions that caused the accident.

76-11 This accident involved a 17 ft 11 in. (5.5 m) semi-V bowrider powered by a 135 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in the drowning of one of the six people aboard and the near drowning of a second person aboard.

At approximately 1600 on July 11, 1976, three adults and three children on the involved boat were returned from a fishing trip on Pamlico Sound in east central North Carolina. The party had been drift fishing with two other small boats in an area approximately 10 mi (16 km) off shore since 0930. During the day the wind velocity had increased from 2 ft to 4 ft (0.6 m to 1.2 m). The boat was located approximately 8 mi (12.9 km) from the launch area and was traveling at a speed of approximately 10 mph (16 kph). The operator noticed that the boat seemed very heavy and the bow was almost submerging when the boat went over a wave and the bow went into the valley. He slowed the boat to approximately 5 mph (8 kph) to negotiate the waves. Shortly after slowing down, the bow sliced into a wave swamping

the forward section of the boat. All the occupants moved aft to increase the bow freeboard. A wave then broke over the transom completely swamping the boat. The motor stopped from water intake, the boat turned and was capsized by a wave hitting broadside. Four of the occupants stayed with the boat until rescued by one of the other boats in the party. Unknown to the four occupants and the crew of the rescue boat, an adult female and a nine year old female had been trapped under the boat when it capsized. Both occupants under the boat were wearing AK-1 PFDs. The rescue boat searched the accident area for the two missing persons for approximately 15 minutes. The rescue boat then left the accident site toward the marina to alert Coast Guard search and rescue. On the way to the marina a commercial fishing vessel with a marine radio was spotted and stopped. The Coast Guard was called by radio and dispatched a helicopter and rescue boat to the accident area. The Coast Guard Auxiliary was also notified and dispatched a rescue boat. The helicopter located the capsized boat and hovered in the area until it was low on fuel. The helicopter then dropped a flare and left the scene. The Coast Guard and Coast Guard Auxiliary rescue boats located the capsized boat by heading toward the flare. The two rescue vessels were not equipped to raise the capsized boat. A commercial trawler with hoisting equipment was contacted and arrived on the scene approximately four hours after the accident. The boat was hoisted aboard the trawler. When the boat was raised the two occupants were discovered and taken out of the water. Attempts to revive the nine year old were unsuccessful. The adult was revived in approximately 15 minutes. The adult had lost consciousness from lack of oxygen. The nine year old had apparently lost consciousness from lack of oxygen and drowned. The adult had her legs through the steering wheel which probably prevented her from drowning.

The major factors in causing this accident are the inexperience and overconfidence in his boat on the part of the operator in that the water conditions that existed at the time of the accident exceeded the safe operating limits of a bowrider of this size. Also, water in the inner hull is a major factor the source of which is unknown.

76-12 At approximately 1700 on July 8, 1976, two men and two women left for a fishing trip on Lake Erie. Their boat was kept in a marina in a protected area. They boarded the boat and left for the lake towards a fishing area where they heard that the fish were biting. When they arrived at the location, they anchored the boat from the port stern cleat and ate dinner, which they had brought with them. After finishing dinner, they pulled in the anchor and began drift fishing. Shortly

after beginning to fish, one of the occupants noticed that there was water in the boat over the cockpit sole. She brought this to the attention of the others, and the operator tried to start the motor to get underway. The engine started but stalled when it was put into gear and would not start again. The occupants began to bail the water out, but by this time the 2 to 3 ft (0.6 to 0.9 m) waves were breaking over the transom faster than they could bail the water out. The boat slowly sank below the surface of the water at the aft end and then rolled over as the occupants swam out of the boat. Three of the occupants held onto the boat near the bow and the other was swimming in the area. Several boats passed nearby but apparently did not see the overturned boat. The occupant who was not holding onto the boat decided to swim to shore for help. She swam for about an hour before reaching shore. People on shore saw her and called the rescue squad. The rescue squad signalled a passing boat which then picked up the rescue squad and went to the overturned boat. The remaining three occupants were taken off the overturned boat and placed in the rescue boat. While on the way to the marina where there were ambulances waiting, one of the occupants died from choking. The other three were taken to the hospital where one was admitted and the other two examined and released. All occupants were wearing AK-1 type PFDs.

It appears that anchoring the boat by the stern in a seaway initiated this accident. Poor location of control cable cutouts was a major contributing factor. There were three cutouts present, two on the starboard side and one on the port side. The off-center loading at the aft end of the boat may also have contributed to lowering the transom enough to allow water to enter. There was no bilge pump in the boat.

76-13 On the afternoon of August 19, 1976, the owner/operator of the boat, his father-in-law, and a 14 year old neighbor left for a fishing outing with a 15 ft (4.6 m) bowrider powered by a 55 hp Chrysler engine. They launched the boat in the Chagrin River inland from Lake Erie. They proceeded into the lake and a short distance southward to a protected cove where they began to fish. They fished for a couple of hours, and then decided to return to the launch area. When they left the cove and proceeded into the main body of the lake, they encountered waves that were much larger than when they had first gone out. Successive waves broke over the bow, filling the boat with water, causing it to capsize. A boat that was nearby came to their aid within a minute. The operator and 14 year old boy were rescued. While they were climbing aboard the rescue boat, the body of the operator's father-in-law, who had sunk out of sight immediately after the capsizing, surfaced. It was taken on board the rescue boat. The 14 year old boy was the only occupant who was wearing a PFD.

This accident was caused by operating an open bow boat in water conditions that proved to be too severe for the boat design.

76-14 This accident involved a 23 ft (7.0 m) fiberglass open fishing boat powered by twin 135 hp outboard motors. The type of accident was a swamping and subsequent capsizing. One person was injured and required hospitalization; there were no fatalities.

A businessman and his teenaged son and nephew set out from a resort town on the New Jersey coast for a Sunday of sport fishing on the ocean. At about 1030 or 1100 they were at least 12 nautical miles (19.3 km) offshore when a large fish of undetermined species struck two of the lines which were being trolled. After awhile some line became fouled in one of the propellers. One, perhaps both, of the engines were shut down at that time. The attention of all three occupants was taken up by the difficulties with the fish while the boat's stern was exposed to the seas, which were probably higher than the reported 1 to 2 ft (0.3 to 0.6 m). The boat took on a large quantity of water, both through the control cable cutouts and over the forward motorwell bulkhead, the effective height of which may have been markedly reduced if a hinged section was open. The boat eventually capsized, and as it did the owner's foot was injured. Time was available before the capsizing, however, for the occupants to don personal flotation devices and to attempt quick distress calls, which apparently went unbroadcast or unheard.

The three men remained on the overturned boat with the aid of an improvised lifeline until rescued almost 24 hours later. They had not left a "float plan" and were not yet considered overdue by their families, so no search was conducted. They were rescued when a commercial fishing vessel happened to pass nearby. The injured boat owner was further evacuated by a Coast Guard boat, and required one day's hospitalization.

Subject to reservations regarding the accuracy of the narrative description of this accident, its chief causes are considered to be the owner/operator's failure to monitor the status of his boat's systems and the action on some occupant's part of shutting down the starboard engine (and therefore possibly the bilge pump). Major contributing causes (and the water's probable entry paths into the hull) would appear to be the large, low, unshielded control cable openings in the motorwell and the (presumably) folded-down motorwell forward bulkhead.

76-15 This accident involved a 16 ft 3 in. (5 m) bowrider runabout powered by a 65 hp outboard motor. The type of accident was a swamping which resulted in no injuries or fatalities.

At about noon on a Saturday, the lone occupant of the bowrider, its 62 year old owner, was drift fishing in Jones Inlet along Long Island, New York's south shore. Wave height was reported to be about 3 to 4 ft (0.9 to 1.2 m). As the boat was drifting with the current and about 100 yd (91.4 m) from the nearest shore, a pleasure cruiser passed close by at a high rate of speed. Its wake swamped the smaller boat over the bow. It filled with water but floated right-side-up and just beneath the surface. The operator remained aboard standing, but did not put on any of several wearable PFDs available. Although there were many other boats nearby, 10 minutes elapsed before anyone responded to his shouts and obvious distress situation. The Coast Guard was called, and a patrol boat arrived on scene shortly afterwards and towed the bowrider to shore.

From the data available, the probable cause of this accident is considered to be the bowrider's inability to handle the large wake from a passing cruiser combined with moderate sea conditions.

76-16 This accident involved a 14-1/2 ft (4.4 m) fiberglass tri-hull bass boat powered by a 40 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1800 on October 21, 1976, three teenage boys were preparing to return from a fishing trip in the Atlantic Ocean near the mouth of the St. Johns River near Jacksonville, Florida. The anchor was pulled in and attempts were made to start the outboard motor. The stern of the boat turned into the wind and waves. While the motor was being started, several waves broke over the transom partially swamping the boat. Shortly after the motor was restarted, a wave broke over the motor cover, causing the motor to stop from water intake. Waves continued to break over the stern until the transom freeboard was reduced to the point that water flowed freely over the transom into the boat. The boat flooded and capsized, coming to rest in an upside down, near level attitude. The occupants climbed on top of the boat and remained there for approximately two hours until rescued by a Coast Guard vessel.

The major factors in causing this accident are failure of the motor to start; allowing the boat to drift into rough water. With a proper operating motor, this boat most likely could have been safely operated in the water conditions that existed at the time of the accident. Also, pulling in the anchor before the motor was started is considered a factor. The anchor should have been retrieved after the motor was started.

76-17 This accident involved a 15 ft 1 in. (4.6 m) tri-hull open runabout powered by a 25 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1200 on October 8, 1976, six adults (three males and three females) were returning from a scuba diving outing near Alligator Reef in the Gulf of Mexico, south of Islamorada, Florida. The party had been diving from a rented boat for about 1-1/2 hrs and had just gotten underway back toward their motel in Islamorada. The boat was traveling approximately 5 mph (8 kph) over 2 to 3 ft (0.6 to 0.9 m) rolling swells and a following sea. As the boat rode up over a wave, the wave velocity increased, causing the boat to surf on the face of the wave in a bow low attitude. The boat then went into the trough and sliced bow on into the next wave, flooding the passenger compartment. Immediately after swamping, the boat rolled to port until it was in an upside down, near level attitude. As the boat rolled, the occupants got out over the port side. The occupants held to the boat for approximately 1-1/2 hrs before being rescued by two 16 ft (4.9 m) runabouts. The boat was towed to the marina and rental agency by a Coast Guard boat.

The major factors in causing this accident are the inexperience on the part of the operator in this type boat in that he was not aware of a large amount of water in the inner hull and its possible effects. Also, the boat was probably overloaded with persons and scuba gear.

76-18 This accident involved a 12 ft (3.7 m) aluminum johnboat powered by a 7 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1445 on October 23, 1976, two men were drifting in the involved boat about 100 yds (91.4 m) offshore in the Atlantic Ocean near Southport, N. C. The men had been troll fishing for approximately five minutes when the motor stopped. The operator was seated in the stern trying to restart the motor. The passenger was seated in the bow fishing. The passenger decided to go aft to see if he

could determine what was wrong with the motor. When he reached the stern; the transom submerged and the boat flooded. As the aft section of the boat flooded, the boat rolled to starboard, dumping both men out of the boat. The boat came to rest upside-down in a near level attitude. Both men, wearing AK-1 PFDs, were rescued by a small johnboat in the area. The involved boat was towed to a small boat harbor by a Coast Guard rescue vessel.

Alcohol is considered the major contributing factor in this accident. The passenger knew that his decision to go to the stern could cause the boat to swamp and an observer on shore warned him that the boat would flood with two people in the stern. He was most likely intoxicated to the level that made him unconcerned of the possible consequences of his actions.

76-19 This accident involved a 13-1/2 ft (4.1 m) fiberglass tri-hull bass boat powered by a 50 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1430 on October 24, 1976, two men were returning from a fishing trip along the Atlantic Coast near Swansboro, N. C. The boat had entered Bear Inlet approximately 3 mi (4.8 km) south of Swansboro and was traveling over a shallow area in 3 to 4 ft (0.9 to 1.2 m) whitecaps. The boat went over a wave, into the trough where the propeller and motor skeg hit the bottom, causing the motor to stop. The skeg began to hit bottom when the stern of the boat went into the wave troughs. The operator grabbed the boat paddle and started pushing the boat in a pole maneuvering fashion toward the center of the inlet where the water was deeper. After pushing the boat approximately 25 ft (7.6 m), the water became deep enough to start the motor. Before the restart was accomplished, three successive waves came over the bow, partially swamping the passenger compartment. The boat then turned broadside to the waves and within a few seconds was taking waves over the port side. The boat rapidly flooded and began to roll to port. The occupants grabbed AK-1 PFDs and jumped out of the boat over the port side. The boat continued to roll until it was upside-down in a bow high attitude. The occupants donned their PFDs and stayed with the boat for about 20 min. until rescued by a small boat that was in the area. The boat was recovered by a Coast Guard rescue vessel.

Major factors in causing this accident are that the operator exercised poor judgment in his decision to cut across the shallow portion of the inlet in three to four ft (0.9 - 1.2 m) breaking waves. Also, overconfidence in equipment certainly resulted in creating the accident situation, since loss of the motor resulted in loss of directional control.

76-20 On the morning of October 11, 1976, two men left on a fishing trip in an 18 ft (5.5 m) outboard boat. They cruised for about an hour and a half to a bait shop near the place they had planned to fish. They bought bait and refilled the fuel tank and then proceeded to the fishing area. There was a slight chop of less than 6 in. (15.2 cm) height at this time. As they were proceeding toward the fishing area, a large "freak" wave broke over the bow of the boat, filling the boat with a considerable amount of water and causing the engine to stall. Both occupants moved to the port side to get PFDs from under the port seat. Before they could don them, the boat heeled to port and then capsized. They held onto the PFDs in the water until a nearby boat rescued them after about 10 min. The rescue boat took them to a nearby hospital where they were examined and released. The boat was not recovered and apparently drifted out to sea.

Operating an open bow boat in unprotected waters that are known to have large waves was the major cause of this accident. Inattention on the part of the operator may also have contributed to the accident in allowing a wave to come directly over the bow.

76-21 This accident involved a 16 ft 9 in. (5.1 m) fiberglass tri-hull runabout powered by an 85 hp outboard motor. The type of accident was a swamping, resulting in no injuries or fatalities.

At approximately 0800 on October 9, 1976, the involved boat was anchored near Morehead City Channel No. 20 approximately 100 yd (91.4 m) from the Fort Macon, N. C., Coast Guard station. The operator/owner (sole occupant of the boat) had been fishing in that location for approximately seven hours. Within a period of five minutes, a thunderstorm moved into the area decreasing the visibility to near zero and causing the water conditions to change from a light chop to 4-5 ft (1.2-1.5 m) whitecaps. Rain and breaking waves completely swamped the boat before the operator could get underway to safety. The operator stayed in the swamped boat until the storm passed (approximately ten minutes) and he was rescued by a Coast Guard vessel.

The major factors in causing this accident are sudden storm creating hazardous water conditions for this size boat along with loss of the motor resulting in loss of directional control. Also, fatigue on the part of the operator is considered a likely contributing factor. He did not realize a storm was approaching until it was too late.

76-22 This accident involved a 16 ft (4.9 m) fiberglass runabout powered by a 115 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 2030 on December 13, 1976, three young men were preparing to drift fish off the Florida east coast approximately 1.5 mi (2.4 km) northeast of Boynton Inlet. The involved boat had been maneuvered to a fishing spot, the motor turned off and preparations were underway to deploy fishing lines. The wind velocity suddenly increased and within one minute was gusting to 25-30 mph (40.2-48.3 kph). Wave heights started to increase and the men decided to return to shore. Before they could get underway, several waves broke over the transom into the boat. When they did get underway, the boat would not come up on plane due to water in the stern. After traveling toward shore for approximately one minute, the fuel line at the motor came loose causing the motor to stop. The boat slowed abruptly, allowing the stern wake to break over the transom flooding the boat sufficiently to reduce the transom freeboard to zero. Water then flowed freely over the transom completely swamping the boat, causing it to capsize. The occupants, wearing Type III PFDs, left the boat and swam approximately 1.5 mi (2.41 km) to shore. The boat later washed ashore and broke up on the rocks.

The most likely major factors in causing this accident are:

- Operating this size boat in the conditions that existed at the time of the accident is considered the major factor.
- Water weight in the stern caused the boat to run in a very stern low attitude. Sudden motor stoppage caused the boat to stop rapidly in a stern low attitude allowing the stern wake to break over the transom.
- Loss of directional control after the motor stopped prevented the operator from maneuvering the boat into the wind and waves.
- Failure of the occupants to notice or react to deteriorating weather conditions.

76-23 This accident involved a 16 ft (4.9 m) fiberglass semi-V runabout powered by a 115 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1400 on November 6, 1976, two men had finished a three hour scuba diving outing in a reef area located approximately 1 mi (1.6 km) southeast of Hillsboro Inlet in the Atlantic Ocean. Prior to diving, the men had deployed a diving marker anchor line. The men had finished diving and climbed into the boat. The operator, wearing a wet suit, went to the helm to start the motor. The passenger, wearing a wet suit, started trying to break the anchor loose from the ocean bottom. The anchor line became entangled around his right leg and as the boat was moved by wave action it was pulled tight against the starboard side at the stern. Fearing injury to his leg, he put his left foot on the starboard gunwale and pulled very hard on the line trying to break the anchor loose. The anchor did not break loose, and he exerted enough force on the line to cause the starboard stern, because of wave action, to submerge, allowing water to flow freely into the boat. After a considerable amount of water had come into the boat, he managed to free his leg. Water continued to flow in until the boat flooded and capsized. The men were rescued by a nearby Coast Guard Auxiliary boat.

Lack of concern for water conditions on the part of the occupants is considered the major contributing factor in this accident. The water conditions exceeded the safe operating limits for this type boat. Also, anchoring by the stern in rough water is contrary to safe operating practices. Panic on the part of the passenger is considered a major factor in that he physically pulled the stern below the surface when his leg became entangled in the anchor line.

76-24 This accident involved a 15.5 ft (4.7 m) tri-hull bowrider powered by a 40 hp outboard motor. The type of accident was a swamping resulting in no injuries or fatalities.

At approximately 2200 on January 14, 1977, four adult males were going through Hillsboro Inlet in southeast Florida destined for a fishign area approximately 1 mi out in the Atlantic Ocean. Midway through the inlet, the water conditions suddenly became very rough. The men could see the ocean was too rough for their boat and decided not to go out. The operator told the passengers that it was too rough to turn around in the inlet and they would have to go outside the inlet, turn around,

and come back through the inlet. After traveling approximately 25 yds (22.9 m) at idle speed, a wave broke over the stern partially swamping the boat and causing the motor to stop from water intake. The operator tried to restart the motor, but was unsuccessful. The boat turned broadside to the wind and waves and was completely swamped within a short period of time. The boat drifted around the north end of the inlet and was washed near the ocean side of a jetty. The occupants stayed in the boat until it drifted near the jetty. One of the occupants got out and held the boat in place until the other occupants climbed out on the jetty. Within 30 min., the boat sank to the bottom and came to rest in an upright position (6-8 ft [1.8-2.4 m] water depth).

In this accident, inexperience on the part of the operator is considered the major factor. The water conditions exceeded the safe operating limits for this type boat and the operator was unable to determine this until it was too late. Also, alcohol is considered a contributing factor. The men had most likely consumed enough alcohol to affect their judgment and their ability to react properly to a dangerous situation.

76-25 This accident involved a 16.5 ft (5 m) V-hull runabout powered by a 55 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1300 on January 24, 1977, three adult males were troll-fishing near Jupiter Inlet in southeastern Florida. The boat started across a shallow sand bar area where 3 to 5 ft (0.9 to 1.5 m) ground swells were being generated. A wave hit the boat broadside, violently rocking the boat and causing one of the passengers to fall overboard. The other passenger, seated on the port side in a wooden frame chair not secured to the boat, was thrown across the boat into the operator. As the chair and passenger were thrown across the boat, the chair hit the ignition key turning it to the off position and breaking it off flush with the ignition. The operator could not turn the key to re-start the motor. The boat was quickly swamped over the stern. After the boat filled with water, it rolled slowly to starboard until it was in an upside-down, near level attitude. The passenger that had been thrown out held to a wooden bench seat that had also been thrown out. The operator and other passenger held to the capsized boat. The three men were rescued by nearby pleasure boats in the area. The boat was towed to a nearby pier by one of the small boats.

The cause of this accident is attributed to operation in water conditions exceeding the safe operating limits of the boat and overconfidence on the part of the operator. Operating his boat in rough water in the past caused him to assume that the boat could safely cross the rough water. Motor stoppage and loss of directional control due to accidentally cutting the ignition caused the operator to lose directional control.

76-26 This accident involved a 15 ft 2 in. (4.6 m) bowrider powered by a 65 hp outboard motor. The type accident was a swamping with a subsequent capsizing, resulting in no injuries or fatalities.

At approximately 1400 on January 29, 1977, a family group consisting of five adults and three children were returning from a fishing trip in Little Lake Worth near Lake Park, Florida. The party was headed down the Intercoastal Waterway at 5 to 7 mph (8 to 11.3 kph) toward the marina where the boat had been launched about three hours earlier. Two large commercial fishing vessels were sighted coming up the center of the ICW. The operator of the boat maneuvered the involved boat near shore to avoid the wake of the large vessels. He turned the boat bow-on toward the oncoming waves. As the wake approached, the waves seemed to combine with wind waves and increase in amplitude. The boat rode over the first wave, then bow-first into the trough. The next wave broke over the bow completely flooding the boat. Succeeding waves over the bow completely swamped the boat. The boat capsized to starboard coming to rest in an upside-down, near level attitude. The occupants held to the boat until it completely submerged. All of the occupants were rescued by a Sheriff's Patrol rescue vessel. The boat was recovered by a local salvage firm.

Overconfidence on the part of the operator, operating a bowrider of this size in conditions that existed at the time of the accident would most likely be considered hazardous. In addition, there was possible overloading and a failure of a commercial vessel operator to minimize his wake when passing the small boat.

76-27 This accident involved an 18 ft (5.5 m) tri-hull bowrider powered by a 135 hp outboard motor. The type of accident was a swamping resulting in no injuries or fatalities.

At approximately 1500 on March 6, 1977, a family group of two adult males, two adult females, and a teenage boy were coming into an inlet near Miami, Florida, after a pleasure cruise in the Atlantic Ocean. The ocean was relatively calm, but

the inlet was very rough with a confused wave pattern. The boat negotiated several small waves, then encountered a large wave (4-5 ft [1.2-1.5 m]). The boat rode over the crest and into the valley. The bow sliced into the next wave completely swamping the passenger compartment over the bow. The motor submerged and stopped from water intake. All the occupants grabbed AK-1 PFDs and all but one adult male jumped out of the boat. Within five minutes, the occupants in the water and the occupant that stayed in the boat were rescued by nearby pleasure boats. The boat sank to the top of the gunwales, but did not capsize. The swamped boat was towed to a nearby launch ramp where the water was evacuated.

Inexperience on the part of the operator is considered the major factor in this accident. The water conditions in the inlet exceeded the safe operating limits for this type boat and the operator was unable to determine this until it was too late.

76-28 This accident involved a 16 ft (4.9 m) fiberglass semi-V runabout powered by a 85 hp outboard motor. The type of accident was a swamping resulting in no injuries or fatalities.

At approximately 1600 on March 6, 1977, three adult males were drift fishing in the Gulf of Mexico approximately 3 mi (4.8 km) out from Clearwater, Florida. One of the passengers noticed that the stern was unusually low and water was visible in the aft third portion of the boat. The two passengers were standing in the stern section and the operator at the helm amidships. The passengers suspected that the motor had caught on something, dragging the stern down. The passengers informed the operator of their suspicions and proceeded to pull up the motor to check the skeg and prop. At this point, the operator moved to the stern to watch. When the operator reached the stern, the transom freeboard was reduced to zero and water started flowing freely over the transom into the boat. The passengers and operator moved forward immediately, but water continued to flow into the boat until the aft half of the boat was swamped. The boat then sank stern first, coming to rest in an upright position with approximately one-third of the bow section above the water line. The occupants were rescued by a Coast Guard vessel within 10 min. after the accident.

Inattention on the part of the occupants is considered the major factor in that they permitted the transom freeboard to be reduced to the point that water flowed freely into the boat. Also, poor judgment in deciding to stay out until the water conditions approached the safe operating limits of the boat is apparent.

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: 1 August 1976

Date of Accident: 22 July 1976

Investigation: Capsizing/Swamping No. 76-01

### SUMMARY — WYLE ACCIDENT NO. 76-422

At approximately 0930 three 16 year old girls and one 11 year old boy left their waterfront dock in a 15 ft (4.6 m) Larson aluminum open boat powered by a 35 hp Evinrude outboard motor. They traveled up the canal which led from their dock to Lake St. Clair, Michigan. When they reached the entrance to the lake it was rougher than they had expected. At this time they all donned AK-1 type PFDs. They proceeded to a nearby submerged sandbar and were planning on going swimming. One of the girls jumped out of the boat into about 3 ft (0.9 m) of water. At this time, waves began to break into the boat filling it with water and causing it to sink. All the occupants walked to shore except the 11 year old who had to swim for periods when the water was too deep.

## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Instruction	PFDs Worn	
							Before	After
Operator	F	16	120 lb 54.43 kg	Excellent	100-500 hr	Power Sqd	Yes	Yes
Passenger 1	F	16	120 lb 54.43 kg	Excellent	Little	None	Yes	Yes
Passenger 2	F	16	120 lb 54.43 kg	Excellent	Little	None	Yes	Yes
Passenger 3	M	11	65 lb 29.48 kg	Excellent	Little	None	Yes	Yes

The operator of the boat had been operating the family boat on her own since she was 11 years old. The other occupants had no experience operating a boat but had been on boats as passengers before. A local requirement of the area is that in order to operate a boat if you are younger than a minimum age, you must take a prescribed boating course and obtain an operator's certificate. The operator of this boat had taken the course and obtained her certificate.

## 2.0 ENVIRONMENT

The boat was boarded in a protected area so the water was calm at the boarding location. (See Figure 1.) The water conditions in the lake, however were much different. The water was white capping with 2 to 3 ft (0.6 to 0.9 m) waves present. Weather as obtained from the local Coast Guard station was wind 5 to 15 knots, east to southeast. Seas were 1 to 3 ft (0.3 to 0.9 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

The following narrative was formulated after interviewing the operator of the boat and her parents.

#### 3.1 Pre-Accident

On the morning of the accident the operator called two of her friends and invited them out for a boat ride with herself and her younger brother. The boat was tied up to a dock at their shoreside home near the end of a canal leading into Lake St. Clair, Michigan. The boat had a six gallon fuel tank on board which was approximately one-half full. Other gear on board included a fire extinguisher, two pairs of skis, four AK-1 type PFDs and several towels. The four occupants then proceeded along the canal toward the lake. The water surface in the canal was calm. When they reached the mouth of the canal they noticed that there were white caps on the lake and it was much rougher than they had thought it would be. They all donned and fastened AK-1 type PFDs, then proceeded southward to a submerged sand bar where they planned on going swimming. When they reached the bar area, at approximately 1000, which was around another point of land (Figure 1), the operator shut off the motor and jumped overboard into about three feet (0.9 m) of water. She was getting the anchor out to anchor the boat when she realized the waves were larger than she first thought. She decided that it would be best to leave that area.

#### 3.2 Accident

The waves had turned the boat broadside to the oncoming waves by this time. She tried to turn the boat bow into the waves by pushing it around (she was still in the water alongside the boat). The other three occupants were still in the boat. At this time approximately four waves in succession broke over the side into the boat, causing it to sink to the bottom and rest on the sand bar.

#### 3.3 Post Accident

The four occupants left the boat and started walking toward shore along a submerged rock jetty. The water got deeper between the bar and the shore with the maximum depth being

approximately neck level for the three girls. The 11 year old boy had to swim for a short period when the water was over his head. They all reached shore safely and began to look for a telephone to call the operator's parents. After trying several houses in the area, they found one at which the occupants were home. They called the operator's parents and they came to pick up the four boat occupants. The Coast Guard was notified and the occupants of the boat went with them to look for the boat. The boat could not be found at this time, but was found washed up on a rock jetty that evening. It was taken directly to a salvage yard and sold for aluminum scrap.

#### 3.4 Time Sequence of Accident Events

Following is a time sequence of the events of the accident.

- 0930 Three 16 year old girls and one 11 year old boy leave the dock in a 15 ft (4.6 m) boat.
- 0950 They proceed up the protected canal to the lake.
- 0951 The operator realizes the water is rough but does not wish to disappoint her guests so proceeds into the lake.
- 0955 They arrive at the bar area and decide to anchor and swim.
- 0956 The operator jumps out of the boat and into about 3 ft (0.9 m) of water. Waves turn the boat broadside to the oncoming waves.
- 0957 The operator attempts to push the boat around, bow into the waves. Four waves break over the side of the boat filling it with water causing it to sink to the bottom.
- 1005 The four occupants reach shore safely and call for help.

#### 4.0 VESSEL DATA

The boat was not available for inspection as it had been sold as scrap the day following the accident. The following was learned from the owner of the boat.

Boat Length:	15 ft (4.6 m)
Boat Material:	Aluminum
Manufacturer:	Larson
Model Year:	1950's
Hull Type:	Semi-V
Engine:	1967 35 hp Evinrude outboard
Steering:	Cable and pulley system.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The girl that operated this boat had operated a boat for several years and had completed a boating safety course. One important fact that she did not seem to know was the phenomenon that occurs when a wave passes over shallow water such as an offshore bar. The waves commonly crest and break. Had she been more aware of this condition, either through experience or education, she may not have chosen the offshore sand bar to stop at to swim.

An important factor in this accident was the social pressure the operator felt by having her friends along. The operator stated that if she were alone in the boat she would have turned around and gone back to the dock when she first entered the lake and noticed how rough it was. She said that she did not want to disappoint her friends that she had invited to go out. If it were not for this social pressure, she felt this accident most likely would not have occurred.

There is another interesting point that should be discussed. The father of the operator pointed out that small craft warnings are no longer displayed at many of the various marinas and yacht clubs in the area. He said that marine weather used to be broadcast on AM radio following local weather, but that this is no longer done. He said that the only way to obtain marine weather now was to call the Coast Guard, or listen to a special weather station which he did not know existed until after the accident. He also said he did not have the special equipment needed to receive the weather station (VHF).

During the visit to the accident area, the investigator talked with a member of the Coast Guard Auxiliary. He (C. G. Auxiliary) pointed out that the Coast Guard had reduced the number of locations at which craft warnings were posted, relying on the new weather channel to convey the weather. It appears that a study of the benefits of this change in procedure should be conducted.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The cause of the swamping/sinking was attempting to anchor a small boat at a bar area where waves were cresting and breaking.

The cause for being out in that weather was a lack of knowledge of the weather, lack of experience in not knowing the hazards of a bar area and social pressure from guests in continuing the journey after realizing conditions may be too hazardous.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The boat was stopped in an area that had waves breaking. If the boat had been allowed to drift free, it might not have been flooded by the breaking waves. The operator was holding the boat and trying to push it into the waves. With the boat being restrained as it was, as the breaking waves approached, they began filling the boat with water. The four waves in succession breaking into the boat caused it to sink to the bottom. It was an older boat and apparently had no flotation.

FEET

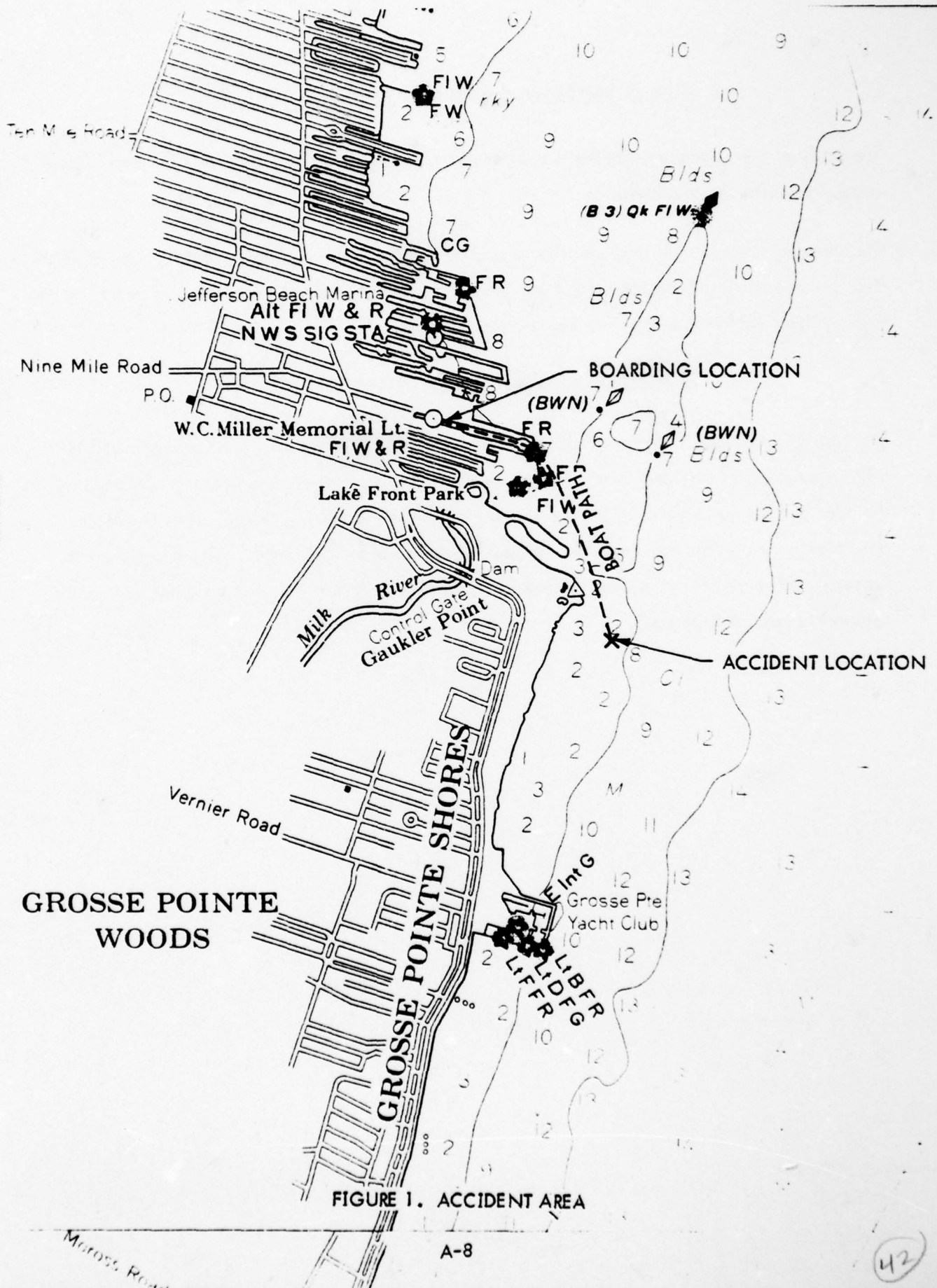


FIGURE 1. ACCIDENT AREA

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: 6 August 1976

Date of Accident: 31 July 1976

Investigation: Capsizing/Swamping No. 76-02

### SUMMARY — WYLE ACCIDENT NO. 76-396

The accident reported herein involved a 12' 2" (3.7 m) open aluminum semi-V fishing boat powered by a 7.5 hp outboard motor. The type of accident was a swamping and subsequent capsizing, resulting in no injuries or fatalities.

At about 1400 on a Saturday, two men were drift fishing inside an inlet along the New Jersey coast. There was considerable traffic in the area, including other boats drifting and larger craft transiting the inlet. The men had been fishing with the flooding current without difficulty. After the current changed and began to ebb, however, the water became turbulent, but the men stayed to fish awhile longer. While headed in against the current, they encountered two successive waves, thought to be wakes from passing boats. The boat did not recover from the first wave, and plowed into the second, which nearly filled it. The operator then shut down the engine to minimize damage to it, and both men exited over the side while holding their buoyant cushions as the boat slowly capsized. They held onto the cushions and the overturned boat until rescued shortly afterwards by a passing Coast Guard boat.

## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Boating Instruction	PFD Worn/Used Before After	
Operator	M	41	210 lb 95.25 kg	Good	> 500 hr	None	No	Yes
Passenger	M	40	200 lb 90.72 kg	Good	< 20 hr	Unknown	No	Yes

### 1.1 Owner/Operator

The owner appeared to be of average intelligence and physical ability. He is married with no children at home, and is employed as a sheet metal worker for a sign-making firm. He lives in an attractive mobile home and seems to enjoy a comfortable standard of living. He is quite sociable and confident, and reports being in good health. He purchased the boat involved in the accident about a month beforehand, and prior to this trip had fished in it each weekend along with his wife in the same area as the accident. The couple had not owned a boat for the past five years, but prior to that had six or seven years experience in boats 14, 20 and 25 feet (4.3, 6.1 and 7.6 m) in length, chiefly on Chesapeake Bay. The owner's experience around inlets was quite limited.

When asked about any previous boating accidents in which he was involved, he mentioned that there had been "some incidents," and related one, of several years ago, in which he backed down too hard while approaching a pier in a current, resulting in his wife's fall overboard from the bow.

### 1.2 Passenger

This person was not interviewed; but it was learned that he is married, has four children at home, is employed as an iron worker, and has never owned a boat. He was said to be in good health. He and the boat's owner became acquainted through their interest in citizens band radio.

## 2.0 ENVIRONMENT

The weather as recorded by a nearby Coast Guard station was 10 to 20 knot winds, three to four foot (0.9 - 1.2 m) ocean swells, and one to three mile (1.6 to 4.8 km) visibility. The current was ebbing at the time of the accident, but its velocity could not be determined from available tables. The Coast Guard coxswain on scene described the water conditions as "turbulent." The water depth in the area varied from about seven to 26 feet (2.1 - 7.9 m). Both the water and air temperatures were described as warm.

## 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

### 3.1 Pre-Accident

The owner/operator retired early Friday night after putting in a five day work week. He rose at 0730 for the fishing trip which he had planned with his friend. They drove about 50 miles (80.5 km) to the New Jersey coast, and transported the boat, motor, and gear in the back of the owner's pickup truck. They launched the boat from a creek bank at about 0930 and proceeded to a popular fishing area inside Little Egg Inlet to catch the incoming current. While in the boat, each occupant sat next to a buoyant cushion, which are the only PFDs the operator owned except for a child's Type II, which was not carried on this trip. They fished for flounder by powering up to a certain point and then shutting down the engine and drifting with the flooding current in the channel, which is also part of the Intracoastal Waterway. There were a large number of other boats in the area (150 according to the operator), but most were larger than his boat. According to both the operator and the Coast Guard coxswain, the great majority of boats using the area are 16 to 18 feet (4.9 to 5.5 m) in length. While the current was flooding, the water surface was relatively calm, and did not cause difficulty for the boat. During the time they fished, the operator drank four cans of beer; his passenger had three cans.

### 3.2 Accident

Persons and gear on board were distributed as shown in Figure 1, and a diagram of the accident area is shown in Figure 2.

Slack water occurred at some time between 1300 and 1400. A short time before slack, the operator had begun another drift, but the boat moved only a short distance shorewards. The operator saw the current change, but waited awhile before starting up to head shoreward. It was his intention to make a few more drifts on the ebbing current, but to a point not as close to the mouth of the inlet, due to the choppy conditions that occur. He proceeded slowly under power ("made a run for it") up the channel. At that time the water surface had become choppy and confused, with about one foot (0.3 m) wave heights, according to the operator.

He then saw two four foot (1.2m) waves ahead, which he assumed to be wakes from several larger boats which were transiting the inlet. He turned and headed bow-on into the waves. The boat was coming down off the first wave when the second one swamped it. Prior to that time, there had been only a minimal amount of water in the bilge. The water put the forward part of the boat down initially.

Upon seeing this, the operator shut down the engine to minimize damage to it from salt water immersion, explaining that he was sure there was too much water in the boat for them to be able to recover. Both occupants remained in their sitting positions as the boat settled and continued to be swamped by the choppy waves. As it then slowly rolled to port and capsized, they grabbed their buoyant cushions and exited over the side. Both occupants remained rather calm during the accident.

### 3.3 Post-Accident

The boat floated inverted and nearly level with the water surface. The accident had occurred about 50 or 60 feet (15.2 or 18.3 m) from shore, and about 25 feet (7.6 m) from several boats whose occupants were also fishing. Although he felt that they could swim to shore, the operator told the passenger that they should remain with the boat. They did not attempt to climb onto or right the boat, but instead held onto it and their buoyant cushions. The passenger also held onto the cooler with the day's catch in it, but let go after awhile when it became too difficult to hold. None of the other boats nearby came to their assistance, except that after a few minutes one boat happened to drift to them and its occupants asked if they could be of help. The operator only asked that they call the Coast Guard.

A Coast Guard boat happened to be patrolling the area, and had observed the capsizing from a distance of over a half mile (over 0.8 km). The patrol boat's crew experienced some difficulty in approaching the boat due to the concentration of fishermen in the area, but was on scene in a short time. The two men were taken on board, and their boat was righted and towed to shore. When first taken in tow, the bow eye had fractured. During the interview, the operator suggested that patrol boats be equipped with boarding ladders.

### 3.4 Time Sequence of Accident Events

- 0730 - Arose and prepared for planned fishing trip
- 0745 - Departed operator's home for fishing area
- 0930 - Arrived at creek, launched boat, and departed for fishing area
- 1015 - Arrived at Little Egg Inlet
- 1015-1400 - Drift fished
- 1400 - Operator noticed current change and water condition worsen
- 1400-1410 - Drift fished in ebbing current
- 1410 - Powered up and started up channel
- 1412 - Boat swamped by two large waves
- 1412-1417 - Occupants held to boat and cushions
- 1417 - Occupants rescued by Coast Guard patrol boat

### 4.0 VESSEL DATA

The boat is a 1973 Delhi model 12SV semi-v open fishing boat constructed of aluminum. It was equipped with a manually started Sears 7.5 hp outboard motor, year unknown, which was clamped to the transom and controlled by hand. The boat's dimensions are 12 ft 2 in. L x 52 in. B x 15 in. D (3.7 m L x 1.3 m B x 0.4 m D). Styrofoam block flotation was installed beneath each of the three thwarts. The capacity plate specified a maximum weight capacity of 545 lb (247.2 kg), a maximum persons capacity of 345 lb (156.5 kg), and a maximum horsepower capacity of 15. The boat appeared to be in good condition. The owner had installed a thin sheet of metal at the upper part of the transom where the motor is clamped, and following the accident had added another bow eye. Refer to Figures 3 through 6.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The boat in question was purchased specifically for drift fishing in the area at which the accident occurred. The owner mentioned several reasons for buying the type of boat he did:

- He wanted a boat light enough so that he and his wife could carry it down a creek bank
- He wanted to avoid buying a trailer, waiting in line at launch ramps, and paying ramp fees
- He wanted a V bow for seaworthiness, having heard of a friend whose johnboat was swamped in the same area
- He wanted to minimize maintenance and upkeep costs, but also have the boat be able to carry two or three people.

The owner's wife wanted him to buy a larger boat; and it appeared as if they could have afforded one. When considering what type and size boat to buy, the owner had the benefit of having fished from friends' boats in the area a few times last season, and of having relatives nearby who had drift fished there for many years. The owner was asked if he knew the boat's carrying capacity. He remembered only that its total capacity was between 500 and 600 lb (226.8 and 272.2 kg), and did not seem to be aware that a persons capacity was also stated. (He had decided to limit the number of occupants to two after the first two trips in the boat with his wife.)

From the above discussion and the analysis of this accident, it would seem that, at least in this case, a boat's capacity plate would do well to indicate:

- The types of water bodies or conditions in which the boat should (or should not) be operated. The owner suggested that perhaps rules be set up to limit the operation of boats as to types of water bodies or distance from shore depending on boat length or type.
- The persons capacity in terms or a format that would be more effective in insuring compliance.

It seemed that "social pressure" may have contributed to this accident: the operator said that he would have headed for home before the current changed direction if his wife had been along, but that he didn't want to disappoint his buddy from bringing home more fish. Perhaps an external standard (such as recommendations on a capacity plate) would have avoided the conflict.

The operator seemed to be aware of the factors involved in the accident; and although he did not have very much experience in the area, it seemed to be a situation in which he "should have known better." From his guarded statements about prior accident involvement, it may be that he is a generally careless or accident-prone individual. It is interesting to note that the boat has since been put up for sale.

## 6.0 PROBABLE CAUSE OF ACCIDENT

Use of a boat not suited for predictable rough water conditions is considered the major causative factor. Contributing factors probably include operator inattention, poor load distribution, operator inexperience with varying inlet conditions, social pressure, and wakes from other boats.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

Although the boat's live load exceeded the capacity plate limitation, the total load did not exceed its limit, although it approached it. However, the live load was probably not distributed optimally for maneuvering through choppy water: the low bow freeboard allowed the boat to be swamped over its unprotected bow.

Turbulent water conditions inside the inlet are a normal, predictable function of winds, ocean waves, and current direction and velocity, and should be anticipated. Choppy waves from this phenomenon apparently combined with vessel wakes to produce waves which were beyond the capability of the small open boat to negotiate, despite the operator's proper handling of the situation by turning into the waves. Although wakes of other boats are probably involved in causing this accident, their existence at an inlet channel along the ICW is a normal part of the water environment that operators of very small boats need to take account of and plan for.

The boat's prompt capsizing following the swamping was likely due to the excessive live load and the low placement of the flotation material.

LOCATION UNCERTAIN:

ANCHOR  
10 - 20 LB  
4.5 - 9.1 KG

COOLER  
20 - 30 LB  
9.1 - 13.6 KG

GASOLINE  
20 LB  
9.1 KG

FISHING TACKLE  
10 LB  
4.5 KG

PADDLE  
5 LB  
2.3 KG

NET  
2 LB  
0.9 KG

BUCKET  
2 LB  
0.9 KG

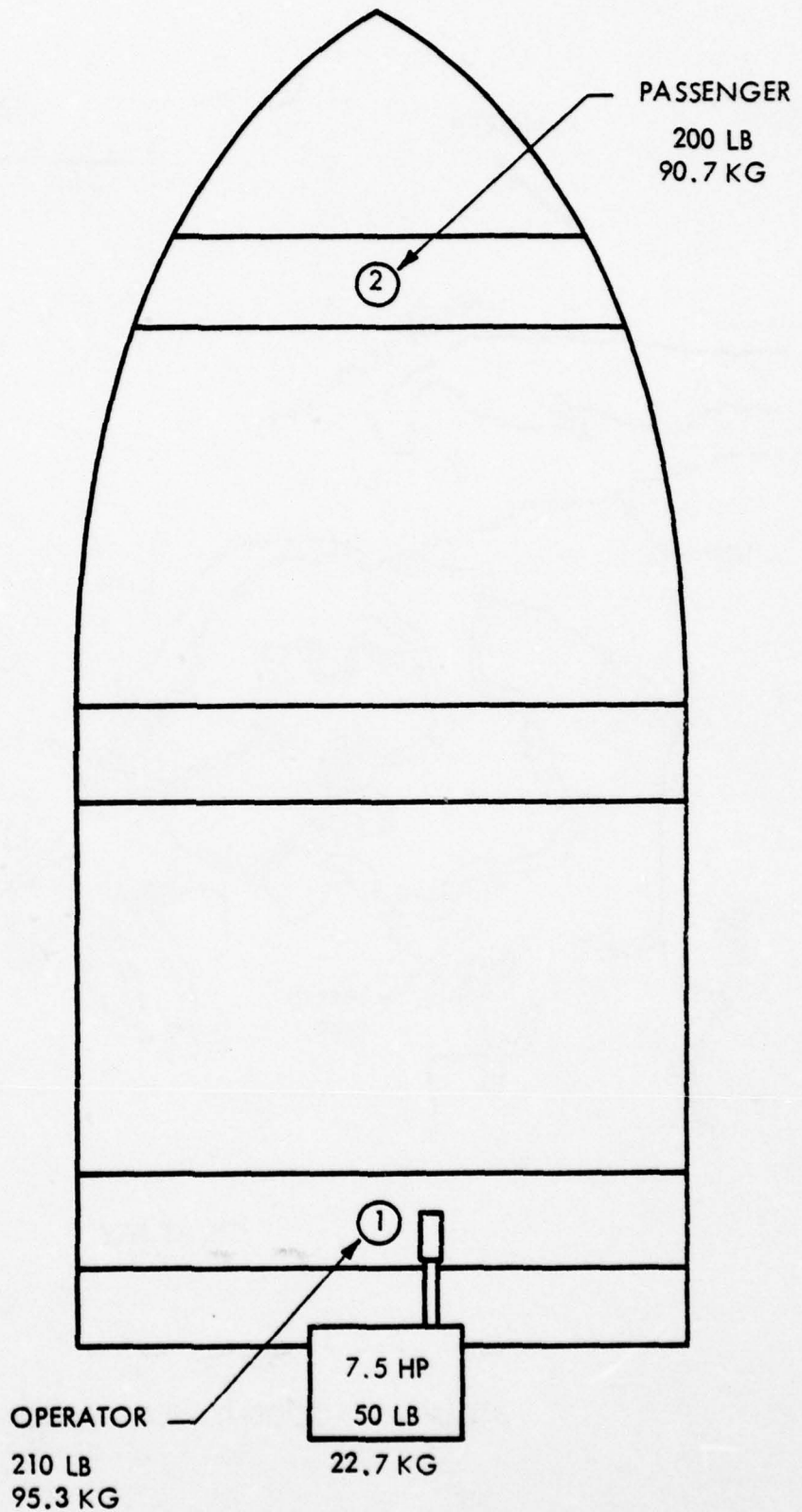


FIGURE 1. LOAD DISTRIBUTION  
B-9

51

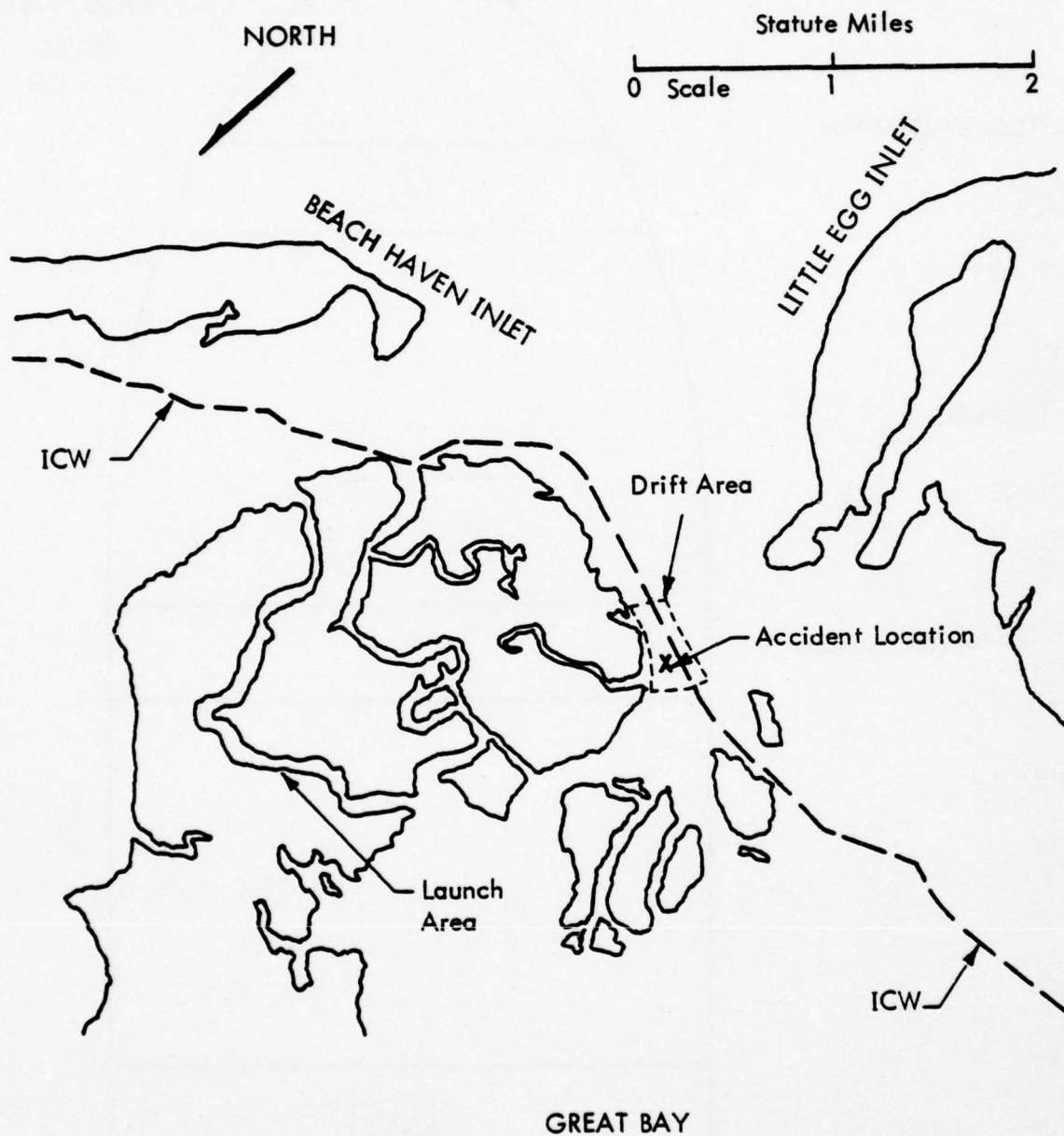


FIGURE 2. ACCIDENT AREA DIAGRAM



FIGURE 3.

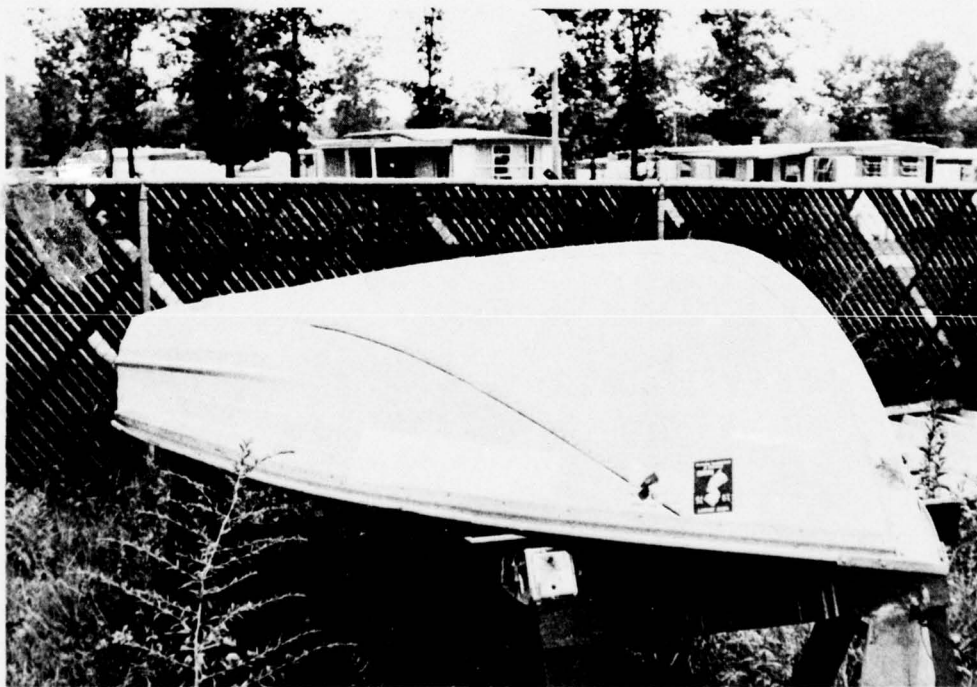


FIGURE 4.

B-11

neg. furnished

53

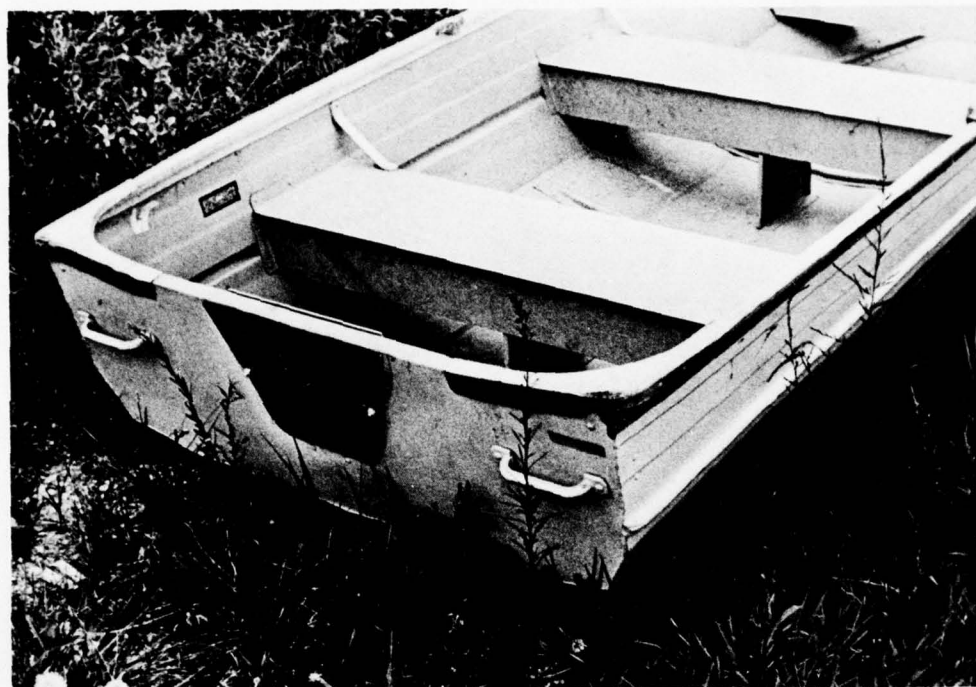


FIGURE 5.

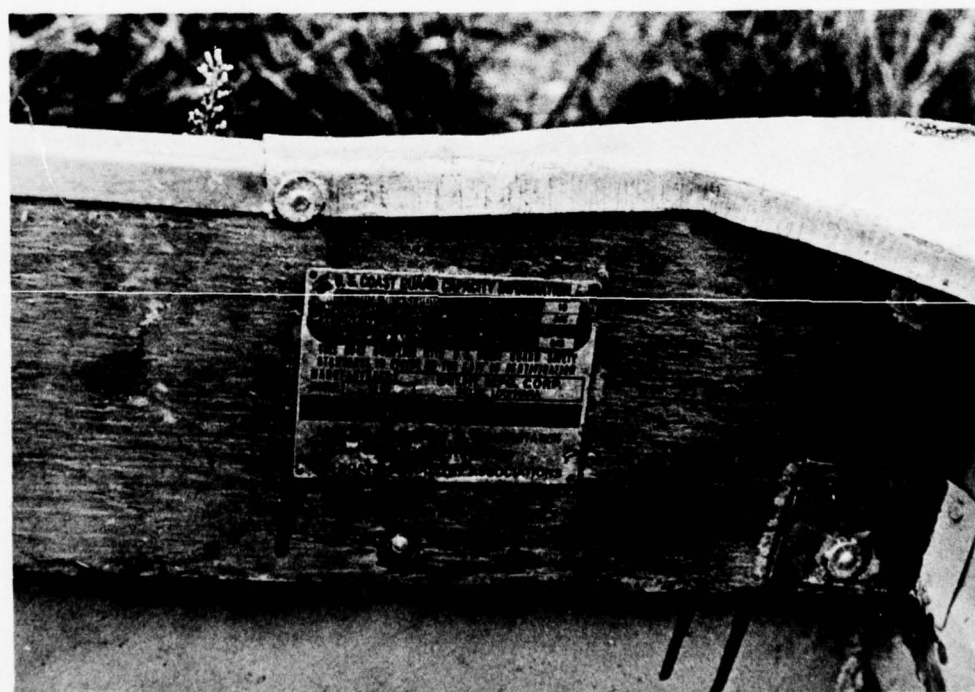


FIGURE 6.

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: 18 August 1976

Date of Accident: 13 August 1976

Investigation: Capsizing/Swamping No. 76-03

### SUMMARY — WYLE ACCIDENT NO. 76-434

The accident described herein involved a 15 ft 2 in. (4.6 m) bowrider runabout powered by a 65 hp outboard motor. The type of accident was a swamping with subsequent capsizing, resulting in no injuries or fatalities.

Three men in their twenties, co-workers on their day off, went out fishing for the day on Long Island Sound. The owner/operator was rather inexperienced: he had purchased the boat three months earlier, and this was his first trip to the Sound in it. Also, he was not aware that water could accumulate in the inner hull.

After staying close to shore during the morning on account of fog, the operator followed a party fishing boat about 8 (statute) miles (12.9 km) to The Race, an area at which tide rips are almost always present. He followed the normal practice of fishing while drifting toward the rip and then powering ahead against the ebbing current. On one drift, he delayed starting up until into the rough water, possibly due to overdependence on the lead of the party boat. Before he shifted the motor into gear, the boat was quickly swamped over the bow. As the occupants began to move about, the boat capsized. Only one was able to grab a PFD, but

all three managed to climb onto the overturned boat. They were rescued by another small boat within a few minutes. The boat was recovered later by the Coast Guard.

#### 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Boating Instruction	PFD Worn/Used Before	After
Operator	M	26	150 lb 45.7 kg	Good	20-500 hr	None	No	No
Passenger	M	~26	~150 lb 45.7 kg	Good	0- 20 hr	None	No	Yes
Passenger	M	~26	~150 lb 45.7 kg	Good	0- 20 hr	None	No	No

The owner/operator was the only occupant interviewed. He is Puerto Rican, is married, has two children, and is employed as a hospital technician. He lives in a single family house in a lower middle-class neighborhood of a large city. He appeared to be of average intelligence and physical ability. During the interview he was not very talkative, and it was necessary to ask him about each aspect of the accident. It seemed, though, that his answers were honest and non-defensive. Prior to this season, he had boated only several times, with friends; and had fished a few times at The Race. He purchased the boat, his first, in May, and had used it about 12 times during the summer, but always on protected lakes and rivers. When they were aboard, his daughters (about five and seven years old) were required to wear their PFDs, but the operator reports wearing his only occasionally. He said that he had not been involved in any previous boating accidents.

All three occupants work at similar jobs in the same hospital. One passenger, the operator's brother-in-law, is single and lives with him. The other, not related, is married and has no children. Neither has owned a boat.

## 2.0 ENVIRONMENT

The weather reported by the Coast Guard patrol boat, which arrived on scene about an hour after the accident, was cloudy with fog, 2 ft to 3 ft (0.6 to 0.9 m) seas, wind NW at five knots, and visibility one-half mile (0.8 km). The air temperature was in the 80's F (26.7 - 31.7 C). The operator described the water temperature as warm. No small craft advisories were in effect. Water depth in the accident area varies from 18 to over 300 ft (5.5 - 91.4 m). When the accident occurred, the current was ebbing at a velocity of one to two knots.

## 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

### 3.1 Pre-Accident

The three men had planned for several days to go fishing on Friday, their weekly day off. The owner/operator retired at 2100 in preparation for the trip. They left home between 0530 and 0600 and trailered the boat about 50 miles (80.5 km) to a public launch ramp on Long Island Sound. The operator checked the weather forecast on local radio stations for the past several days and again that morning. The operator did not open the inner hull drain prior to launching the boat, as he was not aware that water could accumulate in that space.

They got underway between 0700 and 0730 but fished close to shore due to local fog conditions. Each occupant operated the boat during the morning, but none had mentioned any handling or control problems.

By about 1300 the visibility had improved somewhat. The owner/operator followed a large party fishing boat on its afternoon run, as small boats in the area frequently do, about eight miles (12.9 km) across the Sound to The Race. There they bottom-fished by the usual method of drifting with the engine off toward the rip generated by the ebbing current and then powering back before actually reaching the rough water. They followed the lead of the party fishing boat as to how long to drift and how far to run up current. They fished without success for about an hour before the accident. They had brought along some beer, but had only drunk one can each, at about 1100.

### 3.2 Accident

Persons and gear were distributed in the boat as shown in Figure 1. As indicated, the owner was operating the boat at the time of the accident, and all occupants were seated. PFDs were stored in the open compartments along the sides of the boat, next to the seats.

The accident occurred between 1430 and 1530 as the boat was making a drift toward the rip. The operator described the weather at that time as nearly calm wind, visibility under three miles (4.8 km), and water conditions outside the rip (toward shore) fairly calm. He had drifted with the motor off and had just started it to move back up current, but had not yet shifted into gear. He said that "... it was funny; all of a sudden the waves got kind of rough." He later said that they were four ft to six ft (1.2 to 1.8 m) high, and "... were coming from all directions." While the after end of the boat was lifted by one wave, another entered the passenger area over the bow. He said that within about three seconds the boat was almost full of water. All three men made quick motions, either standing up or grabbing for PFDs. The boat quickly capsized to starboard, but all three managed to get clear. Only the passenger in the rear-facing seat had been able to get hold of a PFD, and had partially put it on while in the water. The other PFDs were trapped beneath the boat. About six other small craft were in sight, the nearest about 200 ft (70 m) away. The party fishing boat was also in sight, but by that time had begun moving away from the rip. The closest shore was about two miles (3.2 km) away.

### 3.3 Post-Accident

The boat floated inverted with the stern slightly lower than the bow. The three men managed to climb onto the boat within a short time, but did not attempt to right it. Within about five minutes, one of the other small boats came over and took them aboard. The operator of another party fishing boat noticed the situation a short while later, and used his VHF radio to notify the Coast Guard. A patrol boat transported the three men, dewatered the boat, and towed it to the station.

### 3.4 Time Sequence of Accident Events

- 0530 - Departed owner's home for launch ramp
- 0700 - Arrived at ramp and launched boat
- 0700-0730 - Loaded fishing gear aboard boat and departed ramp
- 0730-1300 - Fished from boat close to shore
- 1300-1330 - Followed party fishing boat across sound to fishing area
- 1330-1530 - Drift fished close to party fishing boat
- 1530 - Boat drifted into rough water, swamped, and capsized
- 1530-1535 - Occupants climbed on top of capsized boat
- 1535 - Occupants rescued by small boat nearby
- 1535-1600 - Coast Guard patrol boat arrived on the scene, evacuated the boat of water, and took the occupants and boat to a nearby marina

#### 4.0 VESSEL DATA

The boat is a 1971 Renken fiberglass tri-hull bowrider, serial number U779-71. It is 15 ft 2 in. (4.6 m) in length, 69 in. (1.8 m) at maximum beam, and 20 in. (0.5 m) transom height. Its capacity plate specifies 1150 lb (521.6 kg) maximum load and 85 maximum horsepower. The plate was difficult to read due to its location, in the motorwell, and its non-contrasting stamped data. A plate indicates that the boat met O.B.C. flotation standards; the flotation material was most likely installed in the inner hull. The boat was equipped with a 1971 Mercury 65 hp outboard motor, bolted to the transom and controlled by a single lever throttle/shift. The boat appeared to be in good condition except for several scrapes and gouges on the hull exterior, said by the owner to have been sustained during recovery operations. He mentioned having made no modifications to the boat, and none were evident. The inner hull drain was opened during the examination, and it was found to contain a large quantity of water. The boat had been stored outside on its trailer, but was always covered. It displayed a current Auxiliary CME decal. It was not equipped with a compass or bilge pump, and portable ones were not carried on the day of the accident. However, a chart, bucket, and hand bailer were on board. Also carried were highway flares, an anchor, tools, and a fire extinguisher. Details of the boat's hull and interior layout are visible in Figures 2 through 5.

#### 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator was obviously inexperienced, both in and with his boat, and with the peculiarities of the area in which the accident occurred. However, he also seemed to be fairly safety conscious, as evidenced by the CME decal and his general attitude. Although the problem could be seen as one of education, this particular boater found that he could not make the time to attend a boating safety course, due to his job and family situations, although he said that he tried. A partial solution in such cases may be a readily noticeable plate on the boat, calling the (unfamiliar) boater's attention to the necessity of draining the inner hull before launching. This owner, at least, would have been more than willing to comply if he had only been aware of the design of this particular boat.

## 6.0 PROBABLE CAUSE OF ACCIDENT

This accident most likely occurred as the result of:

- 1) delay on the part of the operator in moving away from the tide rip, due to some combination of inexperience, inattention, carelessness, and overdependence on the lead of a substantially more seaworthy party fishing boat.
- 2) reduced freeboard due to undetected water in the inner hull.

## 7.0 DYNAMICS/ANALYSIS OF ACCIDENT

Although the boat was not loaded over its capacity plate figure with persons, motor and gear, it quite probably contained a quantity of water in the inner hull enough to exceed the capacity and reduce the freeboard. The inexperienced operator could very likely fail to recognize the impaired handling present in such circumstances. (The amount of water in the inner hull at the time of the accident could have been substantial: the present owner had never checked it, and the last owner reportedly knew very little about boats, having received this one as part of an inheritance.)

The boat drifted toward the rip in time with a party fishing boat, as is the frequent practice: the larger boat has the advantage in locating the "right" place to fish of an experienced skipper, a depth sounder, and radar. A problem arises for small boats, though, according to one party boat owner, when they inadvertently drift into the rip along with the larger boat when it fails to start back up current at the normal point due to problems on board, such as fishermen late in reeling in their lines or two lines being fouled beneath or behind the boat. The inexperienced small boat operator may be unaware of these problems, however. Distracted by his fishing and overdependent on the larger boat, he suddenly finds himself in very dangerous waters.

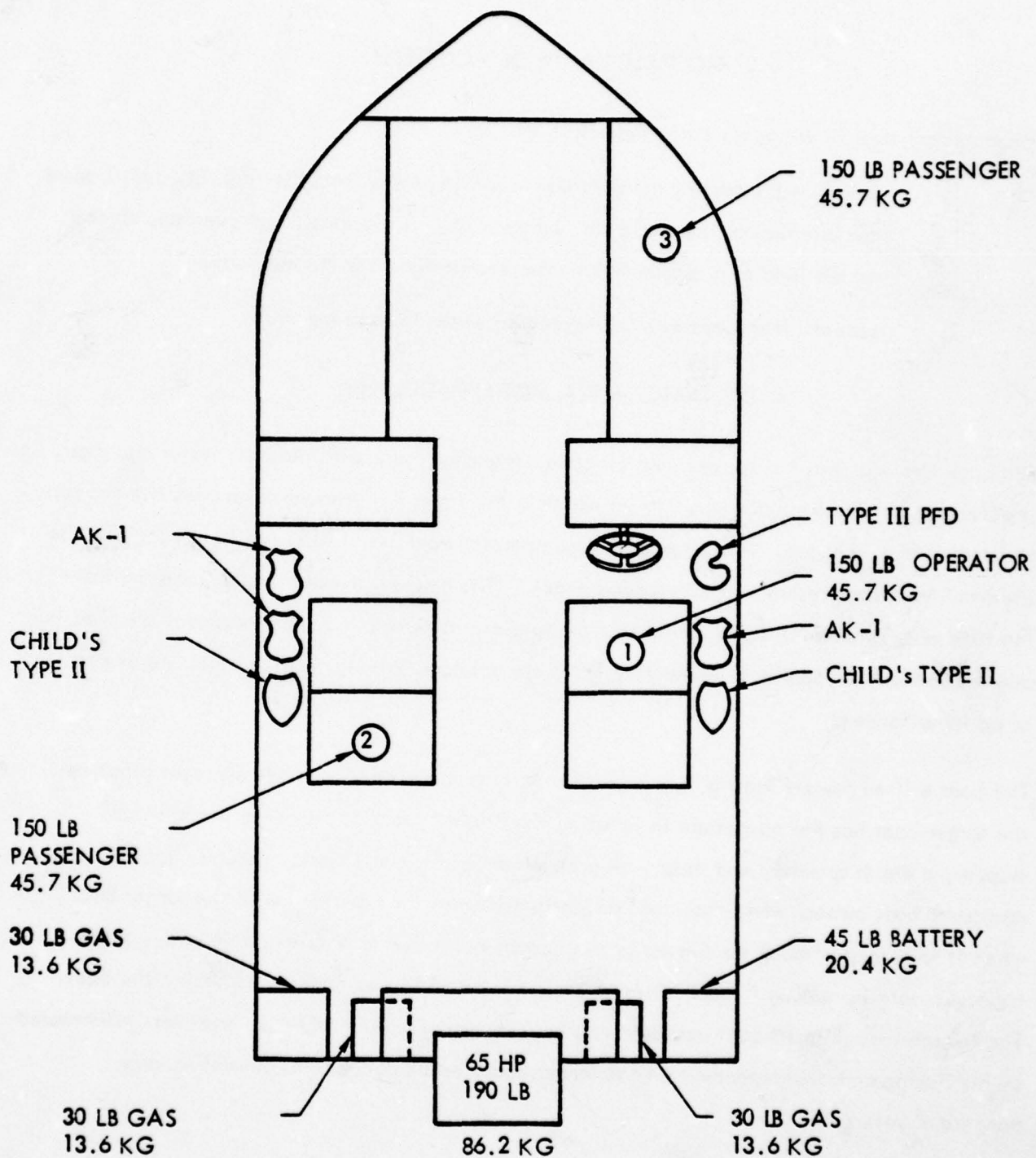


FIGURE 1. LOAD DISTRIBUTION



FIGURE 2.



FIGURE 3.

C-9

neg. furnished

63

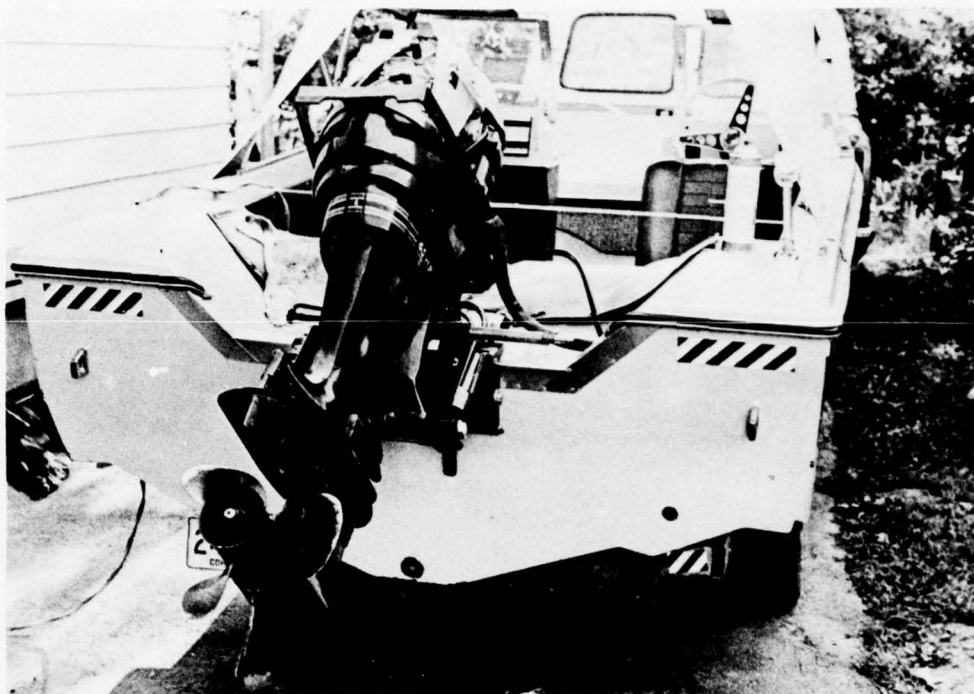


FIGURE 4.

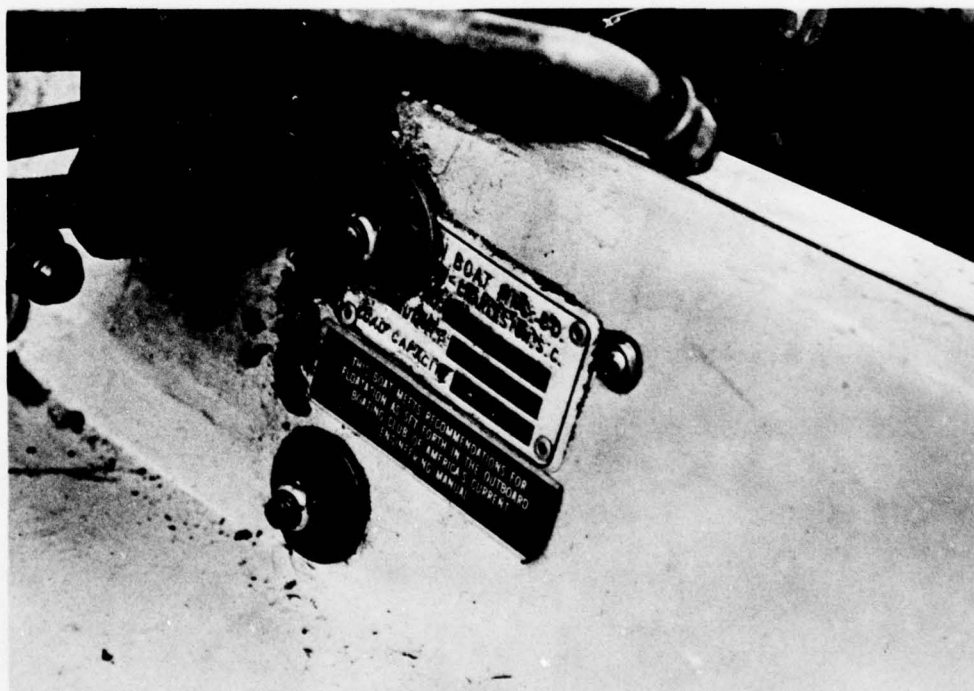


FIGURE 5.

C-10

*neg. furnished*

64

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: August 5, 1976

Date of Accident: May 2, 1976

Investigation: Capsizing/Swamping No. 76-04

### SUMMARY — WYLE ACCIDENT NO. 76-115

The accident reported herein involved a 12 ft 1 in. (3.7 m) flatbottom johnboat powered by a 9.9 horsepower outboard motor. The type of accident was a swamping with a subsequent fall overboard, resulting in no injuries or fatalities.

At approximately 0900 on May 2, 1976, a man, his wife, young son, and daughter arrived at a launch ramp located in southeastern Louisiana for a picnic/fishing outing. The boat was launched in a small canal which ran into a large bayou approximately 1/4 mile (0.4 km) from the launch ramp. The family spent the day fishing and picnicking with the father (operator) alternately taking the boy and girl out to the bayou to fish. At approximately 1545, the family started preparing to return home. During the day, debris had collected on the boat bottom and lower motor unit from running the boat through marsh areas. The operator took the boat out and started running it up and down the center of the bayou to wash off the debris. At approximately 1600, he was headed down the bayou toward the canal that led to the launch ramp at approximately 10 mph (16.1 kph). He noticed a large commercial skiff coming up behind him at a speed of 20-25 mph (32.2-40.2 kph). As the skiff overtook him, he noticed

that the skiff stern wake was 1 ft — 1-1/2 ft (0.3 - 0.5 m) high. He slowed his boat to idle speed and headed the bow of his boat toward the wake at a 45 degree angle. As the bow rode up on the first wave, the boat rolled quickly to starboard, throwing the operator out over the starboard stern. The boat rapidly filled with water and sank stern down with the forward 1/2 of the boat remaining above water. The operator swam back to the boat and pulled it approximately 50 ft (15.2 m) to a wooden picket area close to shore. The skiff returned and the operator of the swamped boat was taken aboard. The swamped boat was partially evacuated of water and towed back to the launch ramp by the skiff.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn/Used</u>	
							<u>Before</u>	<u>After</u>
Operator	M	41	145 lb (65.8 kg)	Good	50 hrs	None	No	No

The owner/operator was the sole occupant in the boat at the time of the accident. He worked as a maintenance engineer for a manufacturing company and seemed to be of average intelligence and physical ability. He stated that he had been around small pleasure boats all his life, but had actually owned only one (the involved boat). It was apparent from the interview that he was an inexperienced boat operator and was not aware of the safety precautions to be employed while operating a small flatbottom boat.

## 2.0 ENVIRONMENT

The sky was partly cloudy, the visibility was good, and the wind was light and variable. The water was calm with very little current. The estimated air temperature was 75°F (23°C), and the water temperature estimated at 70°F (21°C). The water depth at the accident site was approximately 15 ft (4.6 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

On the night before the accident, the operator worked at his regular job from 1500 until 2300. The next day was his off duty day, and he had planned an outing with his family. After completing his work shift, he went directly home and was in bed by 2330. The operator and his family arose at approximately 0730 on the day of the accident and started preparing for the outing. Picnic supplies were packed, and the involved boat was loaded in the operator's pickup truck. The party, including the owner/operator, his wife, 12 year old son, and 7 year old daughter left for the picnic area at approximately 0815. They arrived at the launch ramp and picnic area at approximately 0900. The launch ramp was located on a small canal which led to a large bayou approximately 1/4 mile (0.4 km) away. The operator had planned to fish in the shallow marsh areas along the sides of the bayou. The boat was launched and the fishing gear loaded aboard. The day was spent fishing and picnicking with the operator alternately taking his son and daughter out to the bayou to fish. The operator stated that he did not take both children out because the wife did not want to be alone at the picnic area.

At approximately 1545, the party started preparing to return home. During the day, weeds and debris had collected on the boat bottom and motor from operating the boat in marsh areas. The operator decided to take the boat out to the middle of the bayou and run it in the clean water to wash off the boat and motor. While the wife and children were packing and loading the picnic supplies, the operator took the boat to the bayou.

#### 3.2 Accident

Gear aboard was as shown in Figure 1 and the weather as noted in Section 2.0.

At approximately 1600 the boat was in the middle of the bayou, traveling at approximately 10 mph (16.1 kph) back toward the canal that led to the launch ramp. The operator noticed a large commercial skiff approaching him from the stern at a fast speed (20-25 mph (32.2-40.2 kph) ). The skiff was also in the middle of the bayou, and the operator of the involved boat did not know if the skiff operator could see his small boat. To avoid a possible collision,

the operator maneuvered the involved boat near the west bank of the bayou. As the skiff passed, the operator could see that the stern wake was large (1 ft — 1-1/2 ft (0.3 - 0.5 m) waves). He was afraid the waves would capsize his boat if they hit broadside. He slowed the motor to idle and turned the boat until the bow was headed into the waves at a 45 degree angle. As the bow rode up on the first wave, the boat violently rolled to starboard, throwing the operator out over the starboard stern. The starboard stern submerged as the boat rolled and immediately flooded the aft section of the boat. The motor stopped from water intake within two seconds after the operator was thrown out.

### 3.3 Post Accident

The boat sunk stern first in an upright position with approximately 1/2 of the bow section remaining above water. The operator swam approximately 15 ft (4.6 m) to the swamped boat, held to the forward section and swam approximately 50 ft (15.2 m) to an area of wooden pickets near the east bank of the bayou. When the operator reached the pickets, he noticed that the skiff was coming back toward him. He held to the boat and a picket until the skiff pulled alongside. The operator of the skiff helped the operator of the involved boat aboard the skiff, and the two men pulled the port side of the involved boat high enough to drain the majority of the water. The skiff then towed the involved boat back to the launch ramp. See Figure 2 for sketch of accident area.

### 3.4 Time Sequence of Accident Events

0730	Party arose to prepare for outing.
0815	Left for picnic area.
0900	Arrived at picnic area and launch ramp.
0900-0930	Launched boat and prepared fishing gear.
0930-1545	Picnicked and fished in bayou.
1545	Operator left launch ramp for bayou.
1545-1600	Ran boat up and down bayou.
1600	Boat swamped and operator thrown out.
1600-1601	Motor stopped and stern sank.
1601-1602	Operator swam to boat.
1602-1605	Operator swam to pickets, holding to boat.
1605	Skiff returned to assist operator of involved boat.
1605-1620	Water evacuated and involved boat towed to ramp.

#### 4.0 VESSEL DATA

The involved boat was a 12 ft 1 in. (3.7 m) flatbottom johnboat used almost exclusively for fishing. There were no identifying labels on the boat, but it is believed to be a 1969 or 1970 model. The manufacturer is unknown, but it is very similar to the 12 ft (3.7 m) Sears boat. The boat was powered by a 1976 model 9.9 hp Evinrude outboard motor which was clamped to the transom. The operator had installed 1/4 in. (0.6 cm) plywood over the longitudinal stiffeners in the boat bottom to make a smooth deck. Additional boat data obtained during the investigation are as follows:

- Hull Material — Aluminum
- Hull Construction — Welded and Riveted
- Max. Beam Gunwale — 43 in. (1.1 m)
- Max. Beam Chine — 31 in. (0.8 m)
- Max. Transom Width — 39 in. (1.0 m)
- Transom Height — 15 in. (0.4 m)
- Depth Amidships — 15 in. (0.4 m)
- Stability Warning Label — None

Refer to Figures 3 through 7.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

Although the operator stated that he had been around boats all his life, it was apparent from the interview that his knowledge was below average concerning boat operations, particularly the proper and safe operation of a small flatbottom boat. He had purchased the involved boat from a boat rental company eight months prior to the accident and had been out with the boat three times. He had operated the boat in calm water only and had never had to negotiate a wave larger than small stern wakes of small pleasure boats. He seemed to be a very conservative and cautious individual and would probably have reacted to the accident situation correctly had he been aware of the proper procedures required to prevent the swamping.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- Inexperience on the part of the operator is considered the major contributing factor. He exercised poor judgment in trying to negotiate the large wake at a 45 degree angle. He should have headed bow on into the waves and shifted his body weight forward by leaning forward to increase the transom freeboard.
- Failure of the skiff operator to maintain adequate clearance and minimum wake speed when overtaking a small vessel.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The following is presented, based on the narrative, the boat load distribution, and knowledge of the boat characteristics.

According to the estimated weight in the boat at the time of the accident, the boat was not overloaded. However, considering the operator's weight at the starboard stern (normal operating position), the boat would have a tendency to roll to starboard when disturbed about the longitudinal axis. The intercept angle of the boat with the stern wake caused the port bow to impact the wave first. As the bow rode up on the wave, the boat rolled to starboard, causing the weight of the operator to be shifted further starboard in relation to the vertical centerline of the boat. Also, as the bow went up the operator's weight was shifted aft in relation to the lateral axis of the boat, which caused the transom freeboard to decrease to a point that water flowed freely over the starboard stern. The sudden roll and pitch of the boat caused the center of gravity of the operator to shift aft and starboard sufficiently to cause him to be thrown overboard. After the operator was thrown out, the boat had taken on enough water to decrease the transom freeboard to zero, which allowed the boat to flood. The flotation material under the seats kept the boat upright and prevented it from completely sinking.

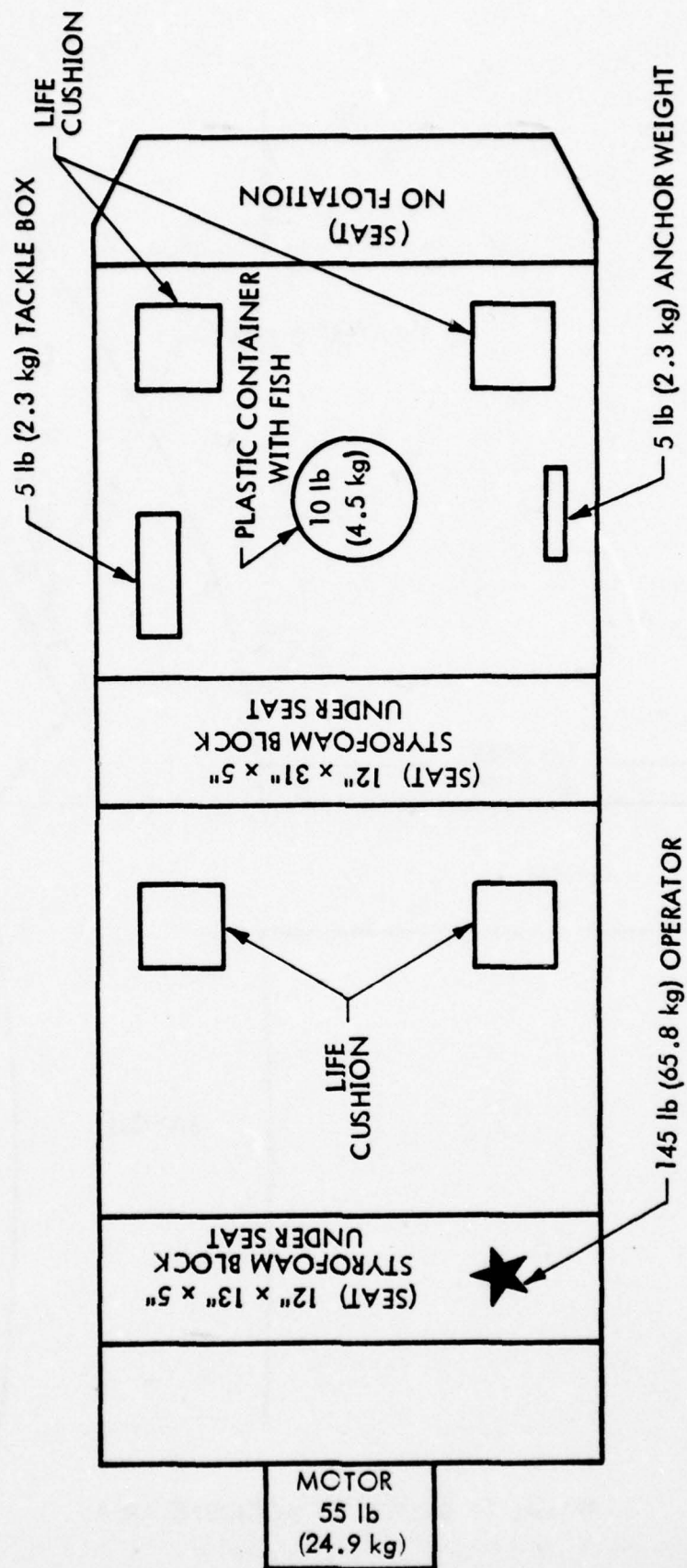


FIGURE 1. BOAT LOAD DISTRIBUTION AT TIME OF ACCIDENT

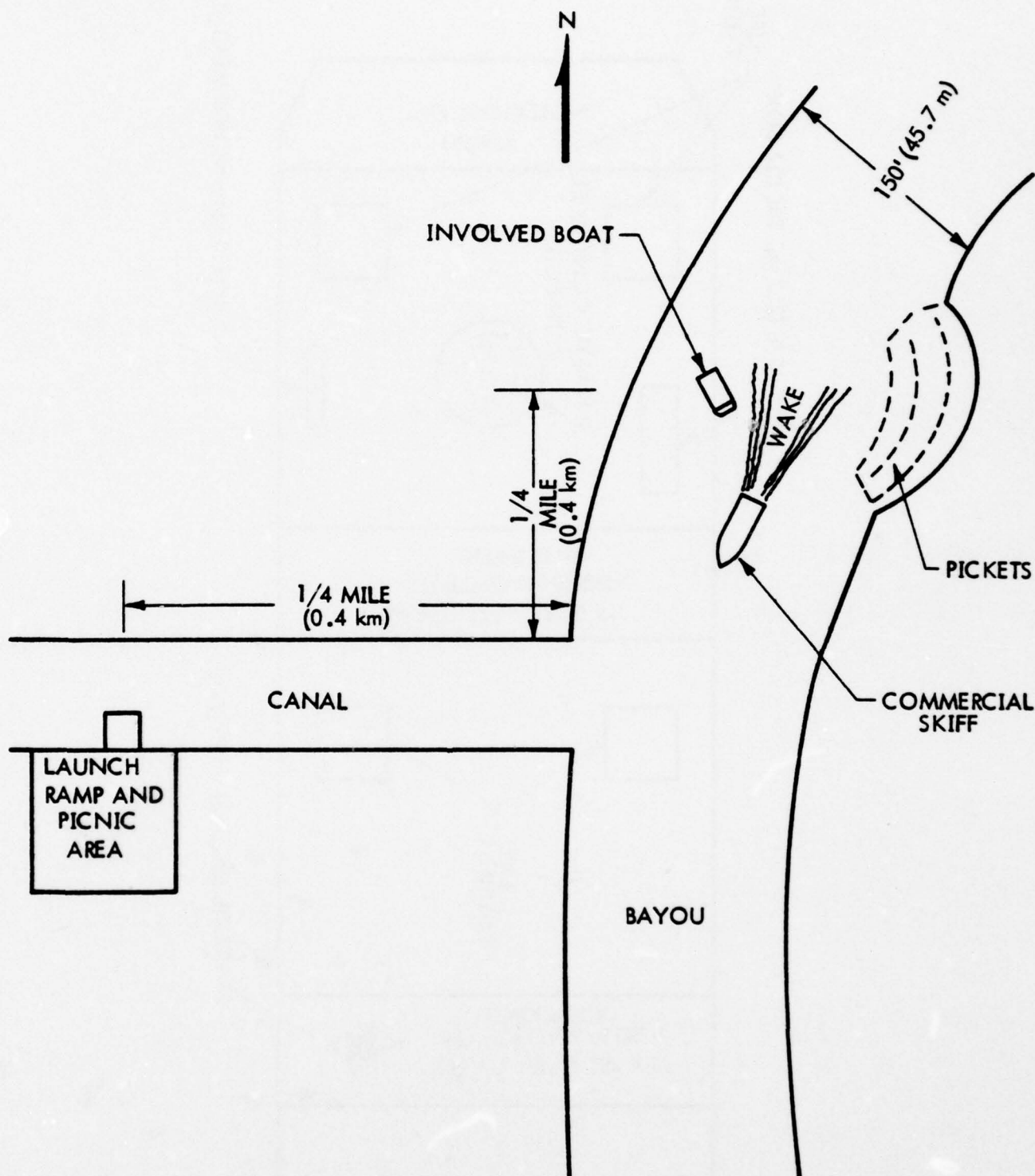


FIGURE 2. SKETCH OF ACCIDENT AREA



FIGURE 3.

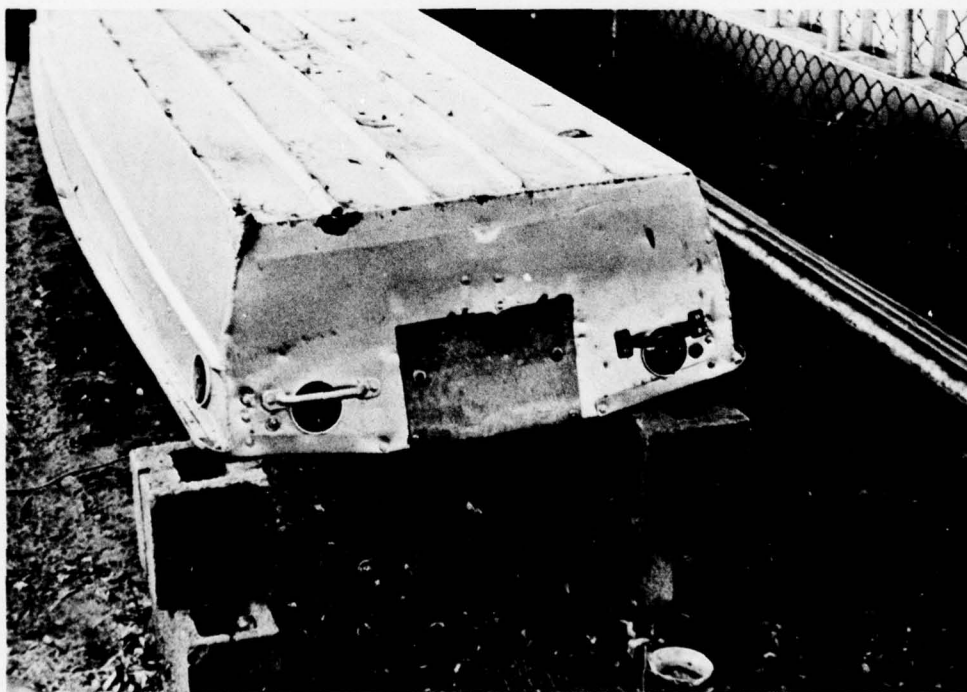


FIGURE 4.

D-13

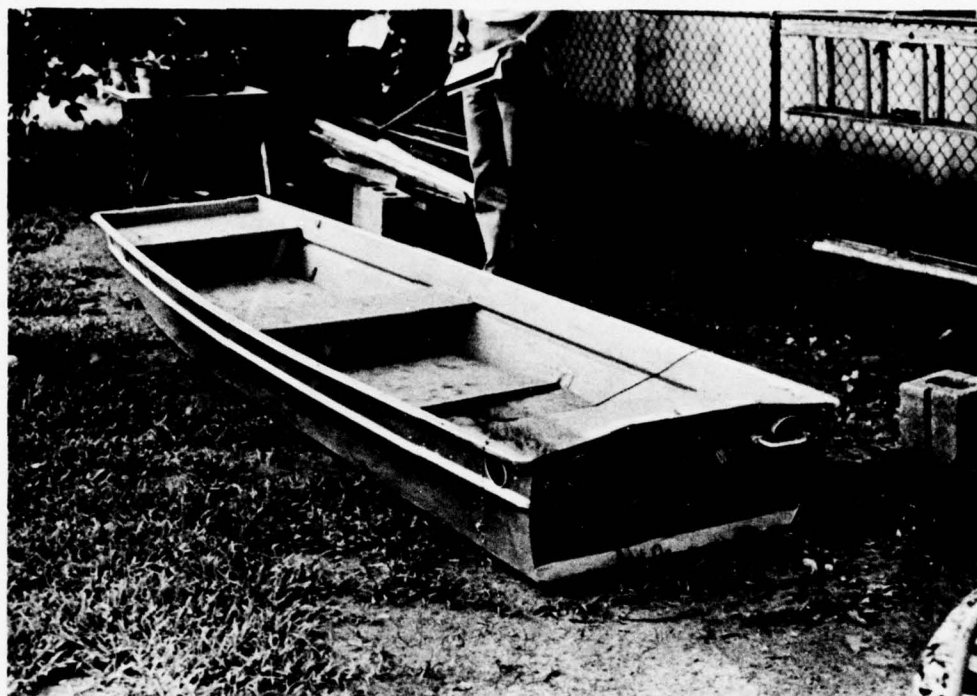


FIGURE 5.

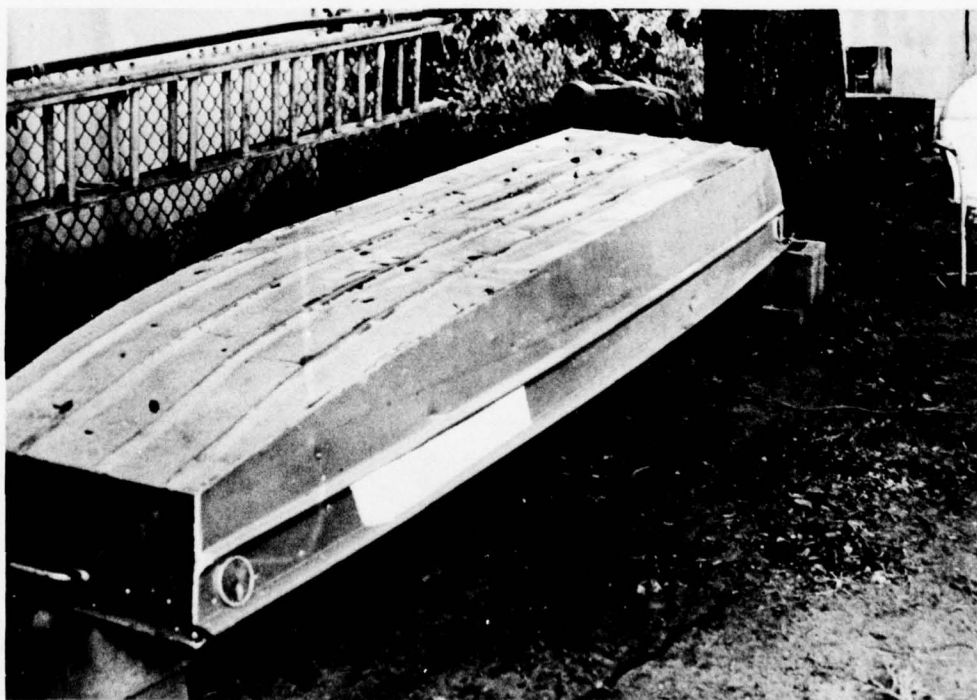


FIGURE 6.

D-14

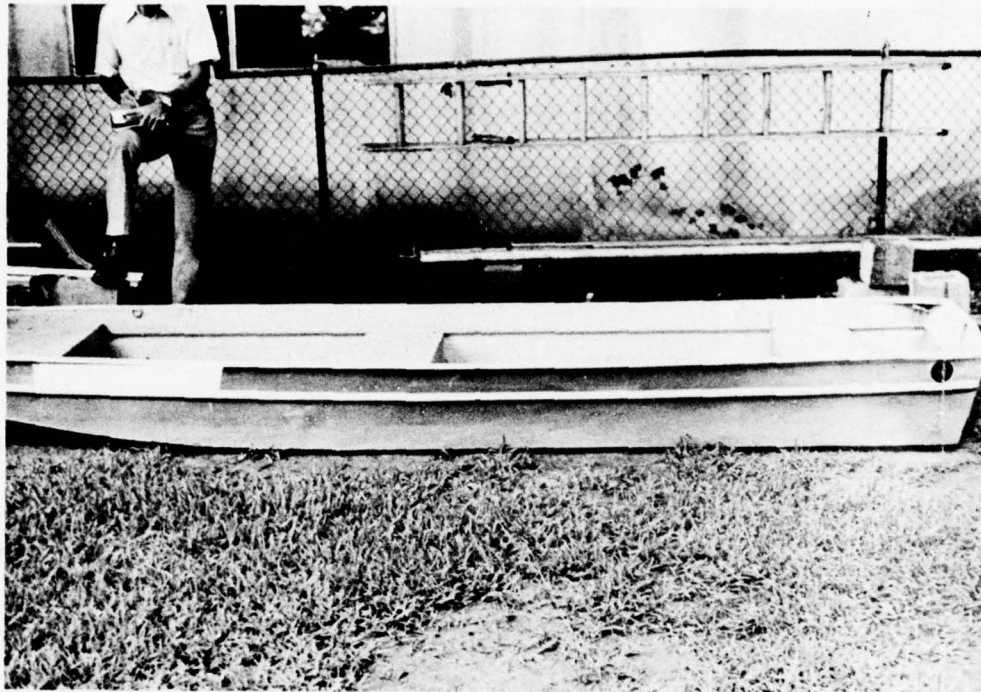


FIGURE 7.

D-15/16

(19)  
80X

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: June 17, 1976

Date of Accident: May 9, 1976

Investigation: Capsizing/Swamping No. 76-05

### SUMMARY — WYLE ACCIDENT NO. 76-112

The accident reported herein involved a 12 ft 2 in. (3.7 m) semi-V aluminum boat powered by a 7.5 horsepower outboard motor. The type of accident was a capsizing, resulting in one fatality and one exposure resulting in hypothermia.

At approximately 1800 on 9 May 1976, two brothers launched the involved boat, which had been borrowed from a friend, at a launch ramp located in northwestern Michigan along the shore of Lake Superior. The two were trolling along the edge of a reef approximately 1/2 mile (0.8 km) from shore in 50 ft (15.2 m) of water. The water temperature was approximately 38°F (3.3°C). Between the time they launched the boat and the accident occurred, the two men had drunk three beers each. The passenger (survivor) had also taken three muscle relaxants, two prior to leaving home and one 10 to 15 minutes before the accident. At approximately 2100, the operator stood up, lost his balance, and fell on the passenger. The boat capsized, throwing both men into the water. The men tried to flip the boat, but were unsuccessful. The passenger began swimming to shore at approximately 2125. The operator was last seen drifting away from the boat. The passenger reached shore at approximately 2200 and ran to the nearest town, reaching there at 0100. He suffered from hypothermia. The operator is missing and presumed dead. The jacket type PFD that the operator had with him is also missing.

## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Boating Instruction	PFDs Worn	
							Before	After
Operator	M	38	160 lb (72.6 kg)	Good	>500 hr	Unknown	No	Unknown
Passenger	M	28	170 lb (77.1 kg)	Good	>500 hr	No	No	No

According to the passenger, he and the operator were very experienced with the particular type boat involved in the accident. The boat, however, was not theirs, but borrowed from a friend. The operator worked, as did most of the people in the town, at a copper mine. The passenger worked in a fiberglass factory and seemed to be of average intelligence.

## 2.0 ENVIRONMENT

The sky was clear, the visibility was good, and the wind was moderate. The water was choppy. The estimated air temperature was 43°F (6.1°C), and the water temperature was estimated at 38°F (3.3°C). The water depth at the accident site was approximately 50 ft (15.2 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

The night before the accident, the passenger had gone to bed at approximately 2200.

On Saturday, May 9, the passenger and operator had worked on their cars all day. They had pulled the motor on one car and relined the brake shoes on the operator's car.

They then decided to go fishing after completing the brake job.

Shortly after 1800 they launched the boat and cruised to an area about 1-1/2 miles (2.4 km) from the launch ramp and about 1/2 mile (0.8 km) from shore. The two men were trolling for trout at the edge of the reef in approximately 50 ft (15.2 m) of water. Beyond the edge, the water depth goes over 900 ft (274.3 m).

According to the passenger, the weather was about what he expected although it was a little windier than he expected. He stated that he had been out several times in similar conditions in the same boat.

The men took a six pack of beer with them and divided it equally between them. The passenger stated these were drunk in the 2-1/2 to 3 hour period before the accident. The passenger had taken two Robaxial (a prescription medicine) prior to going fishing. He also had one pill with him on the boat. He was taking the pills for a back pain. About 10 to 15 minutes prior to the accident, the passenger took the other Robaxial he had with him.

According to the passenger, the men were trolling into the waves at about a 45° angle. The wind was blowing off shore from the east at about 15-20 mph (24.1 to 32.2 kph) according to the passenger. According to the official report, the wind speed was 7-14 mph (11.3 to 22.5 kph). See Figure 1 for a sketch of the accident area.

The operator wore an army field jacket, a heavy sweater, wool slacks, and work boots with felt linings. It was unknown whether he was wearing long johns. The passenger was wearing long johns, Levis, a heavy hunting shirt, a light summer jacket, and street shoes.

### 3.2 Accident

Gear aboard was as shown in Figure 2, and the weather as noted in Section 2.0.

At approximately 1700, the passenger leaned over his tackle box to get another lure. At about this time, the operator also decided to change lures. The operator stood up, lost his balance, and fell on top of the passenger. This caused the boat to flip and throw the two men into the water.

### 3.3 Post Accident

The boat was floating upside down with approximately 1/2 of the bow section remaining above water.

The two men hung on to the boat and tried several times to right it. They successfully righted it once, but in trying to get back in the boat flipped again.

The two seat cushions had floated away and were not available to either man. The other PFD (a jacket) had gotten caught on something in the bow. The passenger was able to free it; he then threw it to the operator who had also grabbed a 2-1/2 gallon (9.5 l) gas tank.

By this time, the men had been in the water for about 25 minutes. The passenger decided to swim to shore and told the operator of his intentions. The passenger began swimming towards shore in a slow, steady, side stroke manner.

The operator was lying on his back, holding on to the gas tank and jacket. Five or ten minutes after the passenger began swimming, he looked back and saw the operator in the same position. At this time, the operator was drifting away from shore, shouting to the passenger. This was the last time the passenger heard or saw the operator (missing, presumed dead).

The passenger had taken his shoes off prior to starting his swim. According to him, it "felt like I'd stuck my feet into CO<sub>2</sub> or something, they froze right up."

The passenger reached shore at approximately 2200. No one was in the area, so the passenger began running back to town to get help. He arrived at the town at 0100.

The two cushions and one gas tank were recovered from the shore. The boat was recovered by the Coast Guard 1/4 mile (0.4 km) from shore.

The body has not been found as of this writing, nor has the jacket. According to the passenger, he saw the operator attempting to put the jacket on, but it is not known whether he succeeded.

### 3.4 Time Sequence of Accident Events

Worked on cars all day Saturday, took two muscle relaxants before leaving home.

1800	Arrived at launch ramp.
1800-1830	Launched boat.
1830-2100	Trolling off shore and drinking beers.
2075	Passenger took one more muscle relaxant.
2100	Operator stood up, boat capsized.
2100-2125	Two men tried to right boat.
2125	Passenger began swimming to shore.
2200	Passenger reached shore, began running to town.
0100	Passenger reached town.

#### 4.0 VESSEL DATA

The involved boat was a 12 ft 2 in. (3.7 m) semi-V boat. It is believed to be between a 1962 and 1964 model E Aluma Craft. The boat had two 7.5 hp outboard motors, only one of which worked at the time of the accident. The working motor was a 1975 model Wards which was clamped to the transom. The non-working motor was a 1958 model Firestone, which was also clamped to the transom. Additional boat data obtained during the investigation are as follows:

Hull Material — Aluminum

Hull Construction — Welded and Riveted

Max. Beam Gunwale — 48 in. (1.2 m)

Max. Beam Chine — Round

Max. Transom Width — 42 in. (1.1 m)

Transom Height — 15 in. (0.4 m)

Depth Amidships — 18 in. (0.6 m)

Stability Warning Label — None

Recommended OBC Horsepower — 12

Recommended OBC Max. Weight Capacity — 557 lbs

Refer to Figures 3-7 for overall boat views.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

According to the passenger, both he and the operator had considerable boating experience, especially with the involved boat. They had been out several times in weather/water conditions that existed on the day of the accident.

The two men had both consumed three beers each over a two hour period. The passenger had taken three moderately strong muscle relaxants; two prior to leaving for the ramp and one 10 to 15 minutes before the accident occurred. According to a pharmacist, these relaxants (Robaxial) affect people differently, even when mixed with alcohol. They may not have any affect on a person or they could render a person unconscious when mixed with alcohol.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- The operator stood up, causing a shift in weight. This shift probably caused him to lose his balance.
- The two men had been drinking, which may have contributed to the operator's inability to maintain his balance when he stood up.

The operator stood up which caused the boat to become unstable in the roll axis. This instability caused the operator to lose his balance and fall into the passenger, causing both men to fall overboard.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

Both occupants were seated on the starboard side which would cause the boat to list to starboard. When the operator stood, effectively, the vertical center of gravity of the boat was raised, which lowered the transverse stability. The dynamic effect of the operator falling into the passenger initiated a sufficient roll moment to cause the boat to capsize and the occupants to fall overboard.

After capsizing, the boat had sufficient flotation material installed under the seats to keep it afloat.

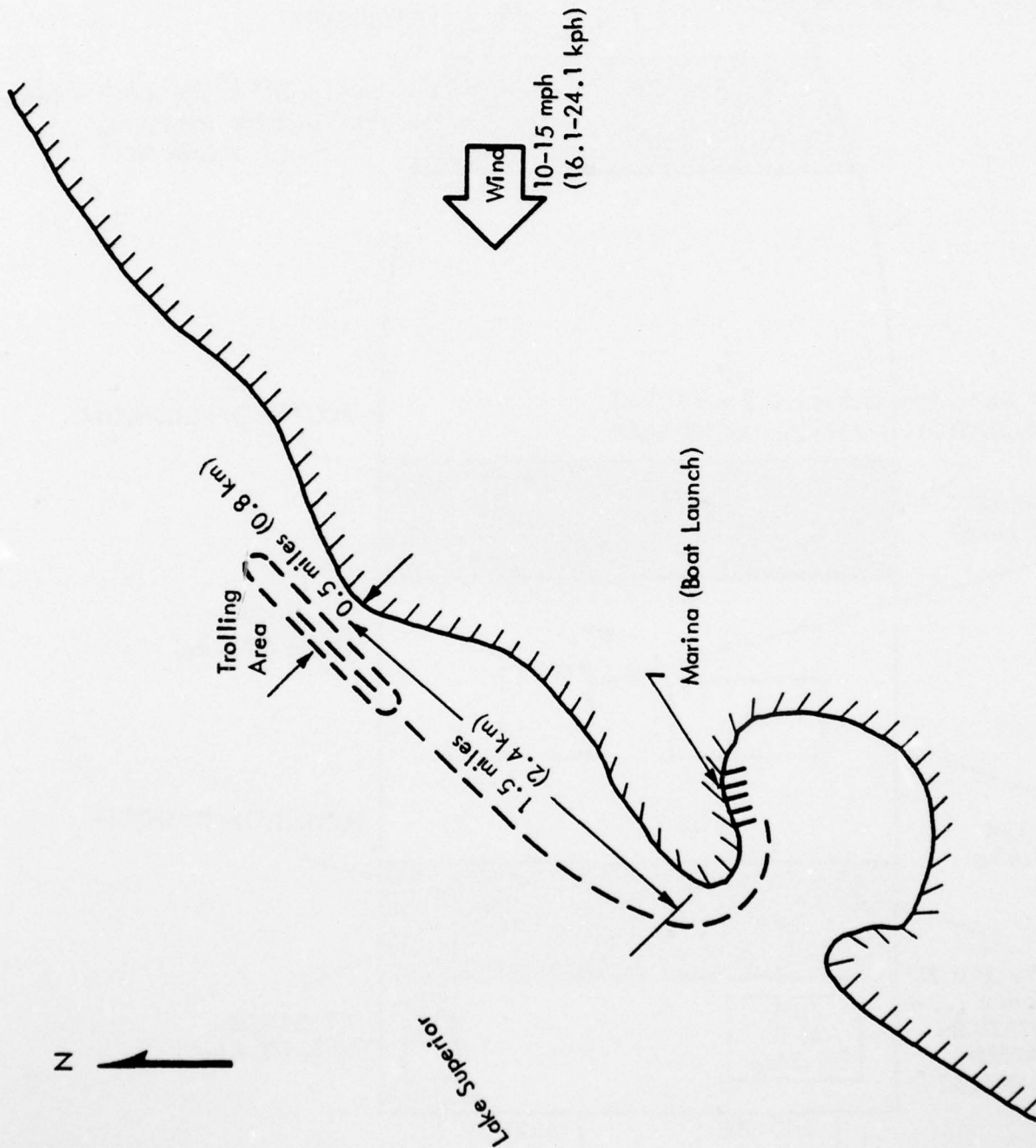


FIGURE 1. SKETCH OF ACCIDENT AREA

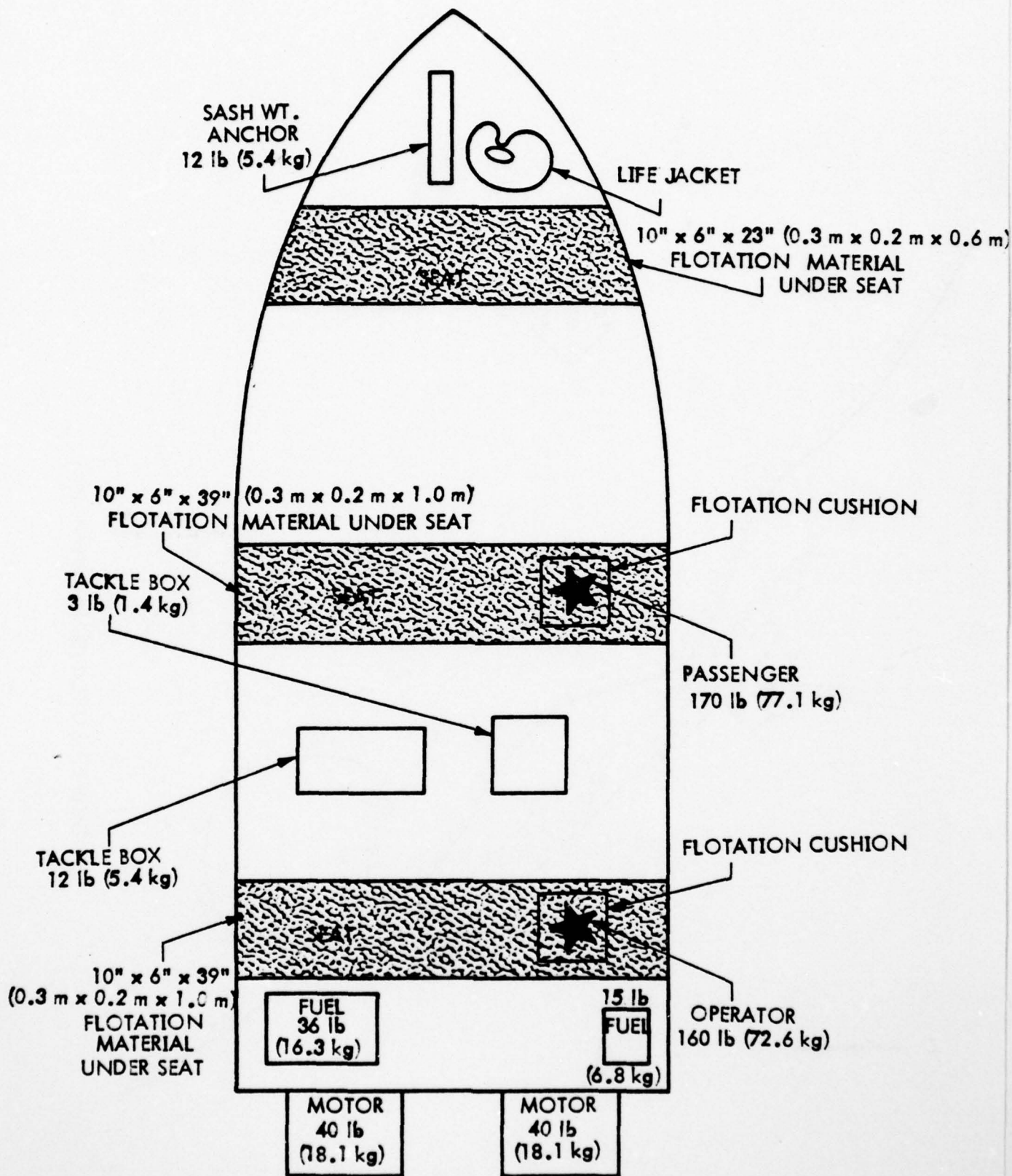


FIGURE 2. BOAT LOAD DISTRIBUTION AT TIME OF ACCIDENT



FIGURE 3.



FIGURE 4.



FIGURE 5.

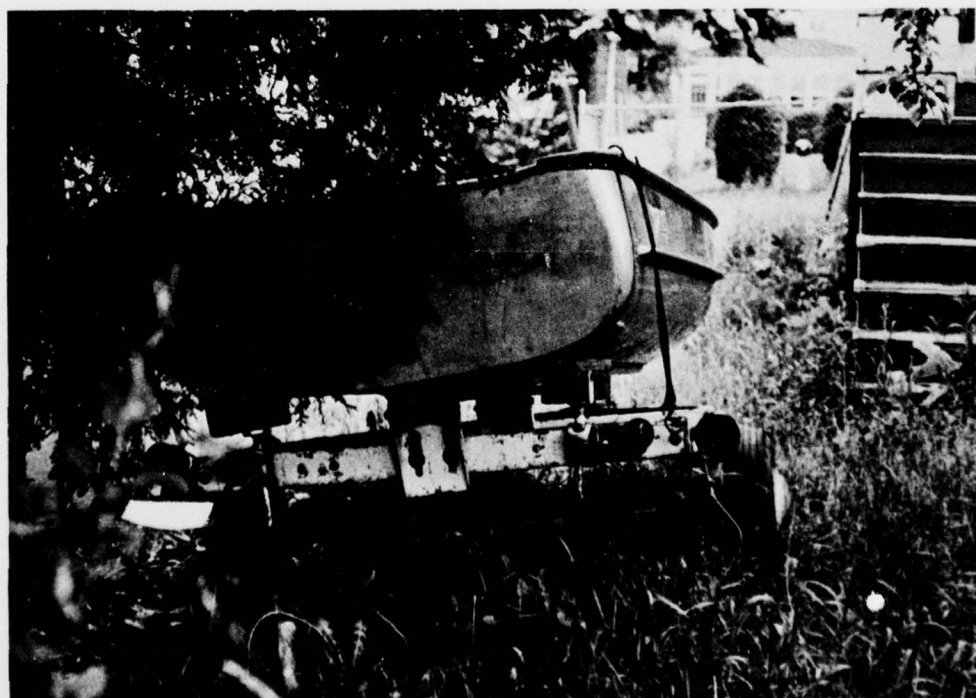


FIGURE 6.

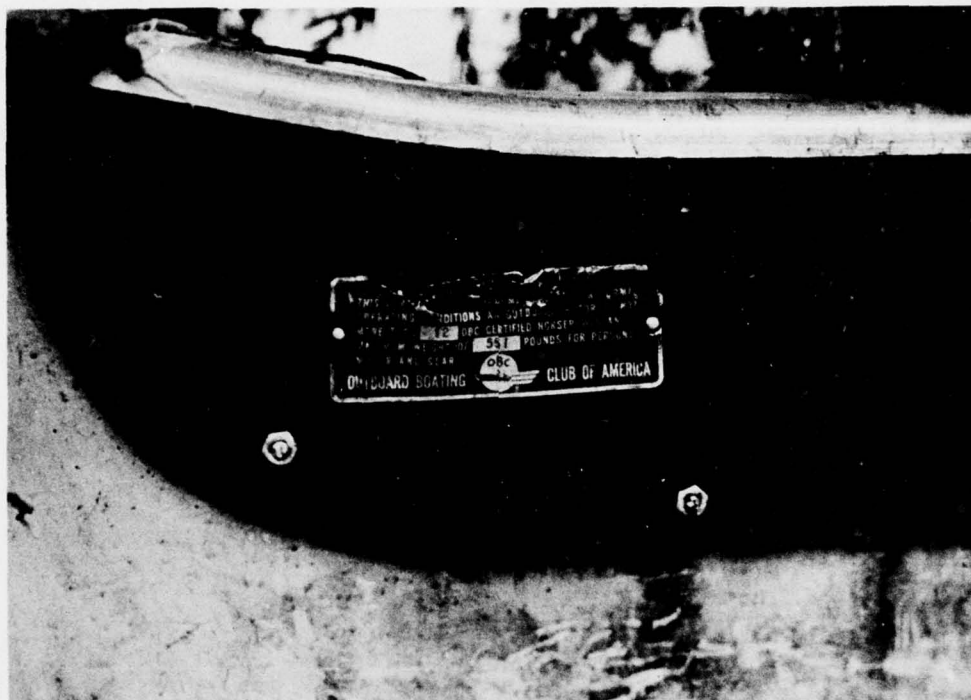


FIGURE 7.

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## ACCIDENT INVESTIGATION REPORT

Date of Investigation: August 18, 1976

Date of Accident: August 7, 1976

Investigation: Capsizing/Swamping No. 76-06

### SUMMARY — WYLE ACCIDENT NO. 76-424

The accident reported herein involved at 15 ft 6 in. (4.7 m) open runabout powered by a 50 hp outboard motor. The type of accident was a swamping of the boat, resulting in no injuries or fatalities.

At approximately 1000 on August 7, 1976, two men reached the shelter of a Coast Guard station located in southeastern Louisiana after aborting a planned fishing trip due to an isolated thunderstorm. The involved boat was maneuvered under a raised helipad, where another small pleasure boat [approximately 25 ft (7.6 m)] with occupants was tied to a support column waiting out the storm. The bow of the involved boat was tied with a line to the stern of the other boat. After being under the shelter for approximately 10 minutes, a third pleasure boat [approximately 18 ft (5.5 m)] came under the shelter to wait out the storm. The operator of the 18 ft (5.5 m) boat threw a bow line to the 25 ft (7.6 m) boat. The line extended from the bow of the 18 ft (5.5 m) boat across the bow of the involved boat and was secured to the stern of the 25 ft (7.6 m) boat. Three to four ft (0.9 m to 1.2 m) waves existed under the helipad. The line between the 18 ft (5.5 m) and 25 ft (7.6 m) boat became tight which prevented the bow of the involved boat to rise with the waves. Subsequently, after the line became tight,

the waves broke over the bow of the involved boat until it was flooded. The boat sank stern first with approximately three ft (0.9 m) of the bow section remaining above waves. As the boat flooded, the two occupants jumped over the side and swam to the 25 ft (7.6 m) boat approximately 15 ft (4.6 m) away. They were taken aboard the 25 ft (7.6 m) boat and transported a few yards away to a ladder where they climbed to safety. The involved boat was retrieved by the Coast Guard a few hours after the accident.

## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Boating Instruction	PFDs Worn	
							Before	After
Operator	M	59	200 (90.7 kg)	Good	100 hrs	None	No	No
Passenger	M	33	170 (77.1 kg)	Good	<100 hrs	None	No	No

The owner/operator was the only occupant available for interview at the time of the investigation. He seemed to be of normal intelligence and excellent physical condition for his age. He was a former golf professional and was employed as a river cargo clerk for a large city. His boating experience consisted of operating two boats over the past six years, a 15 ft (4.6 m) runabout owned by a relative and the involved boat which he had owned for two years. He admittedly was an inexperienced boat operator and had been taught how to operate a boat by a relative who was also an inexperienced operator. When told there were boating safety courses offered by various organizations, he seemed very interested in attending.

## 2.0 ENVIRONMENT

The sky was cloudy with scattered thunderstorms in the area. The wind in the vicinity of the thunderstorms was gusting to 40 knots. The waves in the gulf were ranging up to 12 ft (3.7 m) and the waves under the shelter of the Coast Guard station helipad were from three ft (0.9 m) to five ft (1.5 m). The air temperature was estimated at 75°F (23°C) and the water temperature, estimated at 70°F (21°C). The water depth at the accident site was approximately 20 ft (6.1 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

On the day of the accident, the operator (1) of the involved boat arose at approximately 0300 to prepare for a fishing trip with friends that had been planned a few days earlier. The fishing party was to include six adult males using two boats. (1) called the local weather station and obtained a briefing on the weather and water conditions forecast for the day. The forecast called for three ft (0.9 m) to four ft (1.2 m) seas in the gulf with moderate winds from the northeast until 1400 hrs. After 1400 hrs, scattered thunderstorms were forecast with seas up to 10 ft (3.1 m) and winds up to 40 knots in the vicinity of the thunderstorms.

(1) attached the boat trailer to his auto and departed for the launch area approximately 40 miles (64.4 km) away at 0400. On the way to the launch area, (1) picked up the passenger (2), then stopped at a restaurant where they had breakfast with the other four people in the party, and arrived at the launch area at approximately 0600. There were numerous other boats waiting to launch, and the involved boat and accompanying boat were not launched until approximately 0730. The party had planned to travel down the river to a fishing area located where the river emptied into the gulf. While the two boats were being launched, the operator of a 30 ft (9.1 m) commercial fishing boat told the party he would show them a shorter and faster route to the fishing area. (1) and (2) boarded the involved boat and the other four in the party boarded the accompanying boat [16 ft (4.9 m) runabout]. The two boats left the launch area following the commercial vessel at approximately 0745. The route was down a small canal to the gulf, along the west side of the peninsula, then around the end of the peninsula to the mouth of the river. Upon reaching the gulf, the party found the wind and water conditions to be as forecast [moderate wind and three ft (0.9 m) to four ft (1.2 m) seas]. The two small boats had to reduce speed to approximately 10 mph (16.1 kmph) to negotiate the swells. The commercial vessel was able to go much faster and within a short time was out of sight. After traveling approximately three miles (4.8 km) out in the gulf, the party was not familiar with the area and became lost. A large oil drilling rig was spotted a short distance away, and the party went to the rig to get directions to the fishing area. (2) boarded the rig but was unable to find anyone. He picked up a telephone that was apparently connected to a rig further out

in the gulf. A party answered and gave him directions to the fishing area and told him a storm was approaching and he had better get to the Coast Guard station near the fishing area before the storm hit. (2) told the other men of the approaching storm, and the two boats headed for the Coast Guard station. After traveling approximately four miles (6.4 km), the boats were at the mouth of the river and approximately 300 yds (274 m) from the C. G. station. At this point, the motor on the 16 ft (4.9 m) boat abruptly stopped and could not be restarted. The wind had picked up considerably, and the seas had increased to approximately six ft (1.8 m). A line was tied between the bow of the 16 ft (4.9 m) boat and the stern of the involved boat, and an attempt was made to tow the disabled boat to the C. G. station. After traveling a short distance, the towing eye on the bow of the 16 ft (4.9 m) boat pulled out, setting the disabled boat adrift. At this point a larger pleasure boat [18 ft (5.5 m) to 25 ft (7.6 m)] came by and offered to tow the disabled boat to safety.

The involved boat headed for the Coast Guard station, leaving the towing operation for the larger boat. The involved boat operator found shelter under a raised helipad at the station. A 25 ft (7.6 m) pleasure boat was tied to a concrete support column under the helipad, waiting out the storm which was now at the peak. The bow line of the involved boat was tied to the stern of the other boat. After approximately 10 minutes, (1) noticed that the 18 ft (5.5 m) to 25 ft (7.6 m) boat had abandoned the towing attempt and was headed toward the helipad, and the 16 ft (4.9 m) boat had drifted on the rocks near the C. G. station. A C. G. boat was dispatched and towed the 16 ft (4.9 m) boat to safety. The 18 ft (5.5 m) - 25 ft (7.6 m) boat maneuvered under the helipad and alongside the involved boat, and its operator attempted to throw a bow line around a concrete column [three ft (0.9 m) diameter] to tie the boat off. After several attempts with no success, he threw the bow line across the bow of the involved boat to the 25 ft (7.6 m) boat and asked the occupants of that boat to tie the line to their stern.

### 3.2 Accident

Gear aboard was as shown in Figure 1 and the weather as noted in Section 2.0. The line was tied and almost immediately became tight across the bow of the involved boat. The tight line held the bow of the involved boat down, and the three ft (0.9 m) - five ft (1.5 m) wave started coming over the bow into the boat. The operator of the involved boat told the occupants of the 25 ft (7.6 m) boat to untie the bow line that was stretched across his bow. Before this could be accomplished, a large wave came over the bow, filling the boat approximately 1/2 full of water. The bow line was released and the 18 ft (5.5 m) - 25 ft (7.6 m) boat left the shelter of the helipad. (1) noticed that the water in the boat had flowed aft, causing the stern to go down to the point that water was flowing freely over the transom into the boat. (1) instructed (2) to put on an AK-1 PFD which he did. (1) also donned an AK-1 PFD. As the stern started to sink, (1) and (2) jumped over the port side and swam to the stern of the 25 ft (7.6 m) boat approximately 15 ft (4.6 m) away. They were helped aboard the 25 ft (7.6 m) boat by the occupants of that boat.

### 3.3 Post Accident

The stern of the involved boat continued to sink in an upright attitude until approximately three ft (0.9 m) of the bow remained above water. The bow line of the involved boat was tied to a nearby platform, and (1) and (2) were transported a few yards in the 25 ft (7.6 m) boat to the platform access ladder where they climbed to safety.

After the storm passed (approximately 1400), Coast Guard personnel towed the involved boat until it was on plane, removed the drain plug, evacuated the water, and returned the boat to the C. G. station. Refer to Figure 2 for sketch of accident area.

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CAPSIZE/SWAMPING ACCIDENT INVESTIGATIONS FOR 1976 SEASON. (U)

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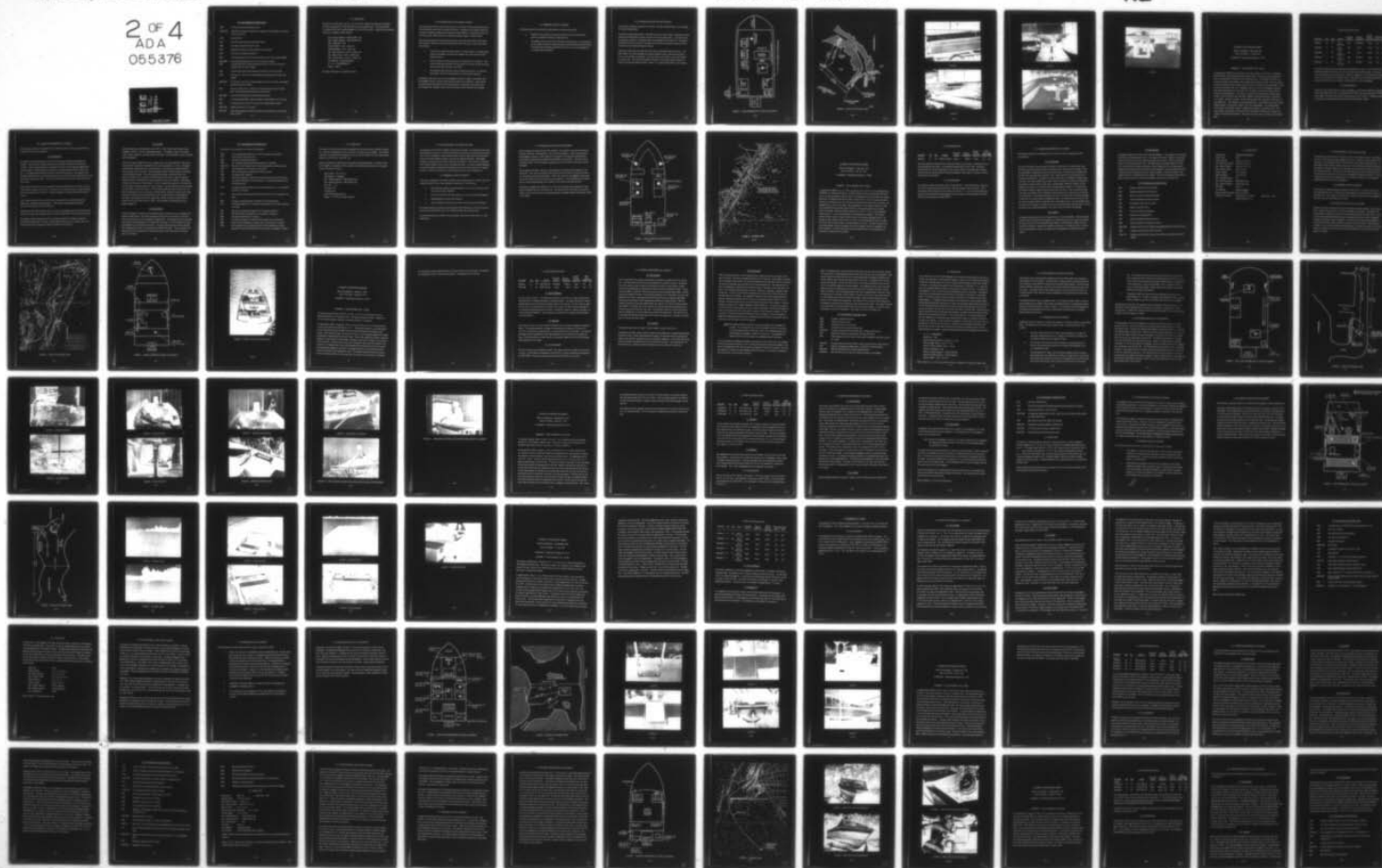
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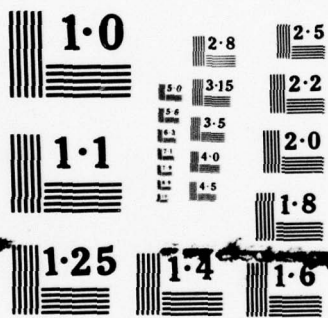
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MICROCOPY RESOLUTION TEST CHART

### 3.4 Time Sequence of Accident Events

0300 (1) arose and started preparing for trip.

0400-0730 Started to launch area, picked up (2), stopped and ate breakfast, and waited turn to launch boat.

0730 Launched boat.

0745 Left launch ramp following commercial vessel.

0805 Lost sight of commercial vessel in gulf.

0810 Boarded oil drilling rig to get directions to fishing area.

0815 Left oil rig for Coast Guard station.

0845 Two boats arrived at mouth of river and motor on 16 ft (4.9 m) boat stopped.

0845-0900 Involved boat attempted to tow 16 ft (4.9 m) boat to safety.

0900 Involved boat left for shelter leaving 18 ft (5.5 m) - 25 ft (7.6 m) boat to attempt towing 16 ft (4.9 m) boat.

0905 Involved boat arrived under helipad and tied off to 25 ft (7.6 m) boat.

0920 18 ft (5.5 m) - 25 ft (7.6 m) boat aborted towing attempt and arrived under helipad.

0920-0925 18 ft (5.5 m) - 25 ft (7.6 m) boat attempted to tie off to column, unsuccessful, tied off to 25 ft (7.6 m) boat.

0925 Bow line of 18 ft (5.5 m) - 25 ft (7.6 m) boat held down bow of involved boat. Involved boat started taking on water over bow.

0925-0926 Involved boat flooded and started sinking by the stern.

0926 (1) and (2) donned PFDs, jumped overboard, and boarded 25 ft (7.6 m) boat.

0930 (1) and (2) got out of 25 ft (7.6 m) boat and climbed ladder to safety.

0930-1400 Waited out storm at C. G. station.

1400-1410 Coast Guard personnel towed involved boat, evacuated water, and returned boat to station.

#### 4.0 VESSEL DATA

The boat was a 1974 model, 15 ft 6 in. (4.7 m) tri-hull runabout manufactured by Manatee. The boat was powered by a 1974 model 50 hp Johnson outboard motor. The steering wheel was broken and the hull, slightly damaged as a result of the accident. Additional data obtained during the investigation were as follows:

Max. Persons Capacity — 330 lbs (149.7 kg)

Max. Weight Capacity — 875 lbs (396.9 kg)

Max. Horsepower — 85

Transom Height — 21 in. (53.3 cm)

Depth Amidships — 21 in. (53.3 cm)

Max. Beam Gunwale — 66.5 in. (168.9 cm)

Max. Beam Chine — 54.5 in. (138.4 cm)

Max. Transom Width — 66.5 in. (168.9 cm)

Hull Material — Molded fiberglass

H. I. N. — MNT02894M74J

Model — 1550 T

See Figures 3 through 7 for overall boat views.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator stated that he would not have gone out on the day of the accident had he known that thunderstorms were likely to develop in the area. According to the weather forecast he obtained, scattered thunderstorms were forecast for after 1400 hrs. He planned to return from the fishing trip by 1200 to prevent the likelihood of getting caught in severe weather.

When the party became lost and obtained directions to the Coast Guard station, they based their decision to proceed to the Coast Guard station rather than return to the launch area on the following:

- The storm was northwest of their position, moving southeast. The Coast Guard station was southeast, and they were confident they could reach the station before the storm.
- The canal that led to the launch area was northeast from their position. They were not sure they could reach the canal ahead of the storm and also they were not sure of the exact location of the canal.
- They believed that other boats would be headed toward the C. G. station to seek shelter, and if they had trouble they would be able to get help.

The operator stated that when he and the passenger reached the shelter of the helipad, they felt reasonably certain the boat would ride out the storm with no difficulty. When the bow movement became restricted by the line across his boat, the operator was uncertain what would happen and, therefore, did not know what action to take to prevent the swamping.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- Restriction of the vertical movement of the bow by the line across the bow section is considered the major contributing factor.
- The operator was not aware of the limitations of his boat due to his inexperience. He was unable to analyze a hazardous situation and take proper corrective action. The flooding may have been prevented had he known to move his passenger aft to increase the bow freeboard.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The following is presented, based on the narrative, the boat load distribution, and knowledge of the boat characteristics.

According to the estimated weight in the boat at the time of the accident, the maximum weight capacity was 240 lbs (108.9 kg) less than the value on the capacity plate. The maximum persons capacity as stated on the capacity plate was exceeded by 45 lbs (20.4 kg). According to the operator, there was no water in the boat until the vertical movement of the bow was restricted and waves started breaking over the bow.

Apparently a large volume of water came over the bow and flowed freely to the stern. The water weight in the stern decreased the transom freeboard to zero, which allowed water to flow over the transom into the boat. The heavy motor on the transom would cause the boat to sink stern first. The location of flotation material in this type boat (double bottom and halfway up each side) caused the boat to remain in an upright attitude after it was swamped.

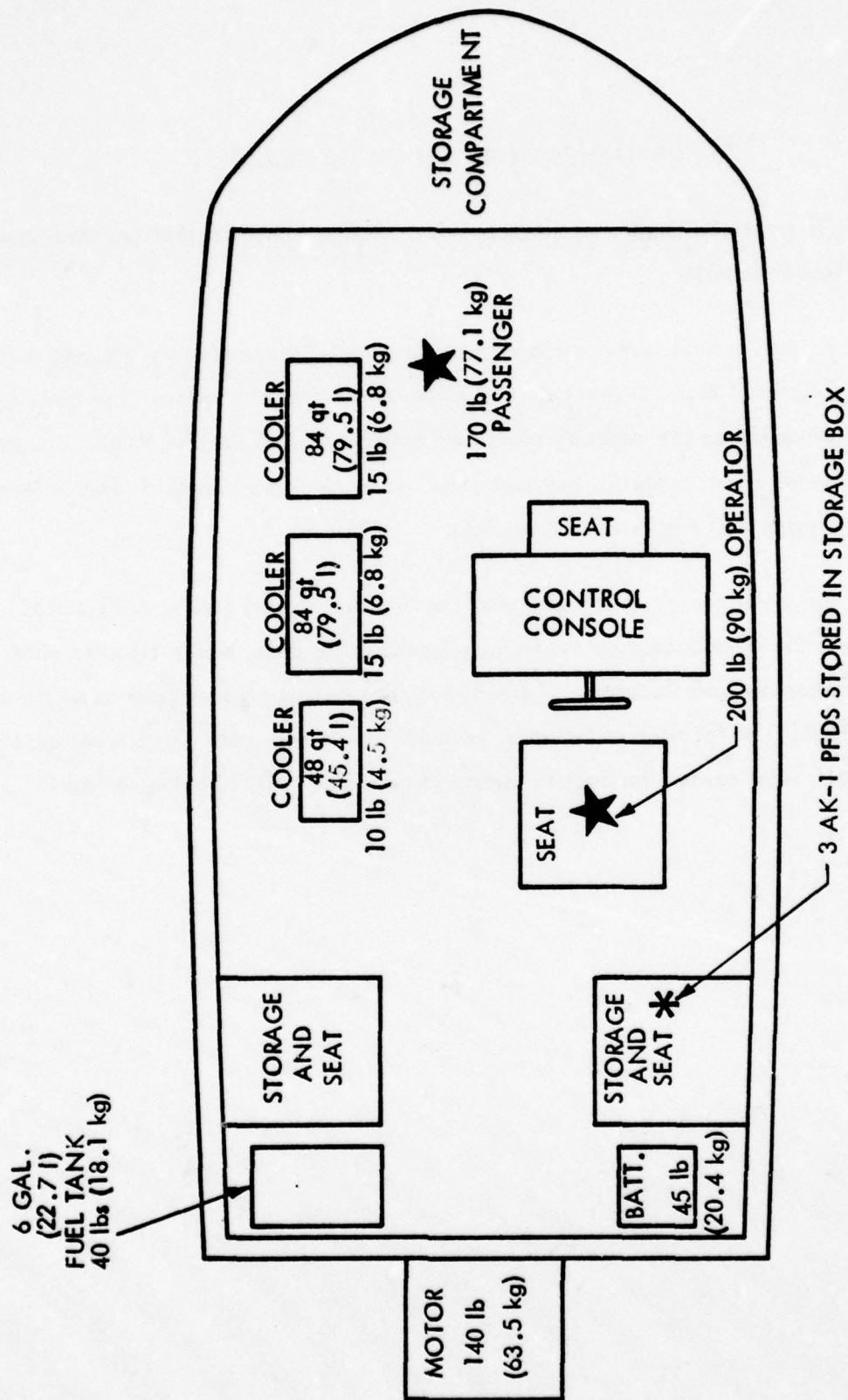


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

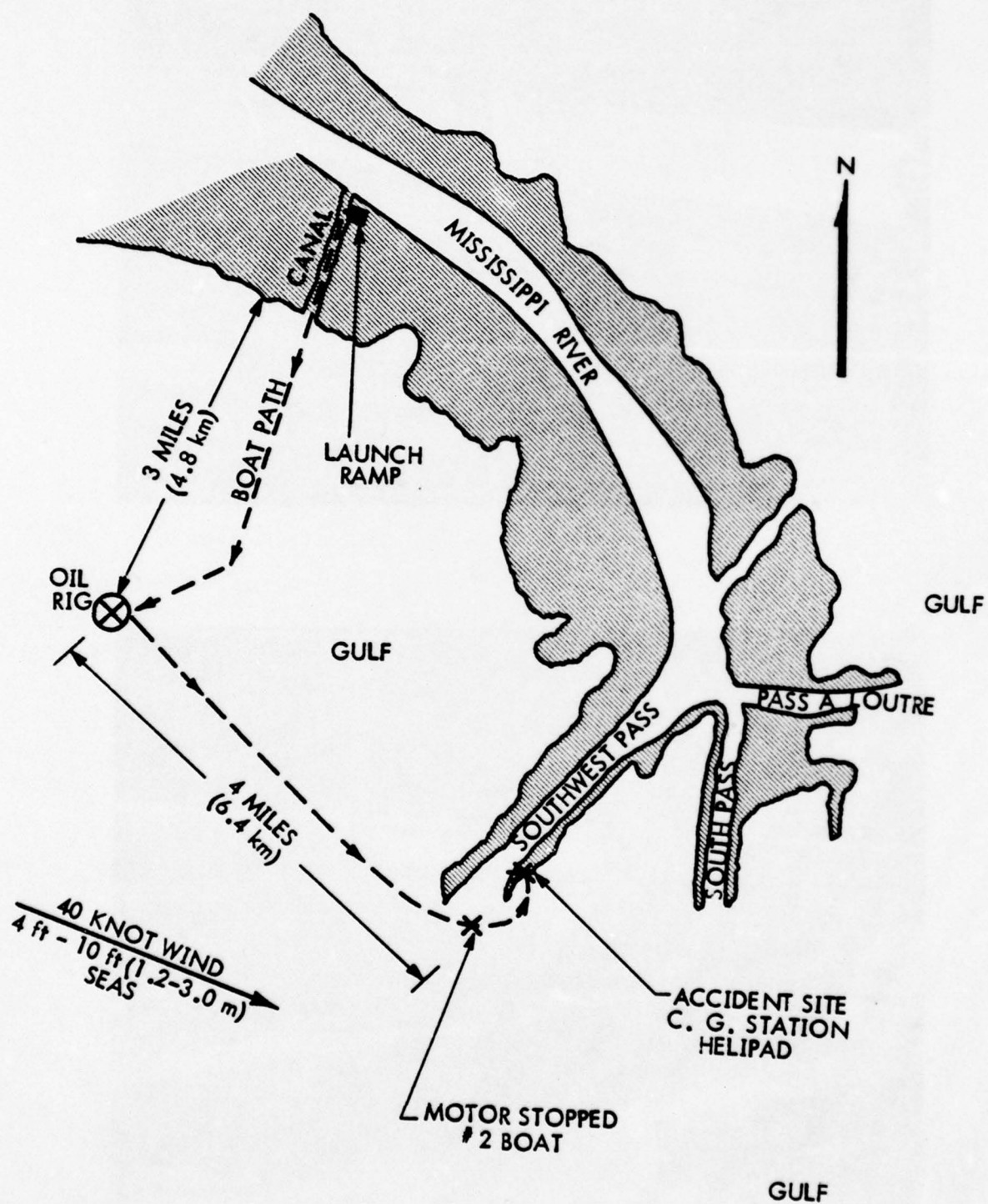


FIGURE 2. SKETCH OF ACCIDENT AREA

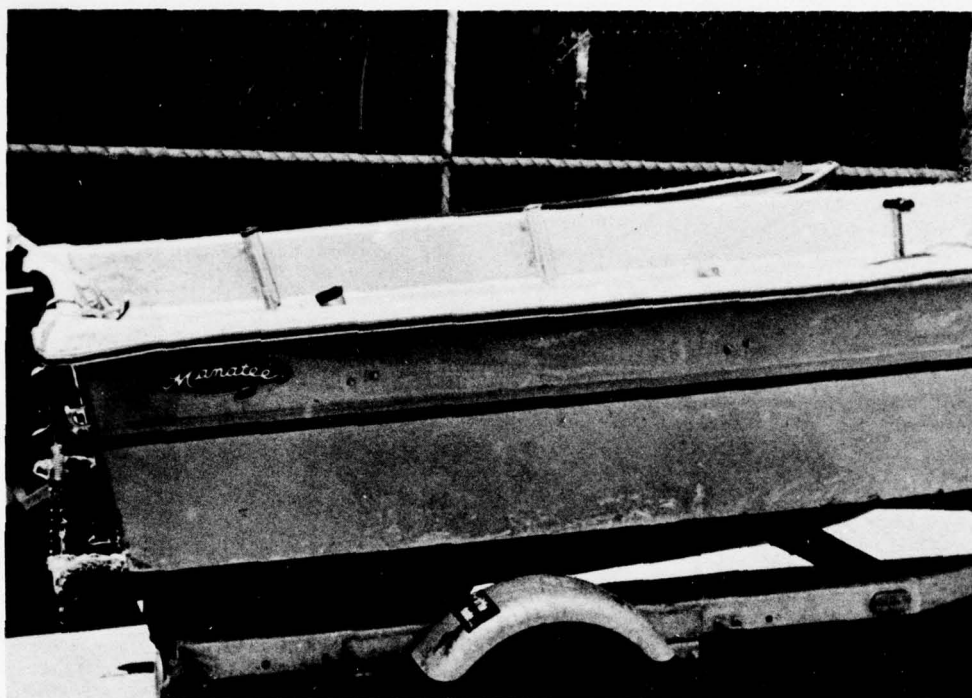


FIGURE 3

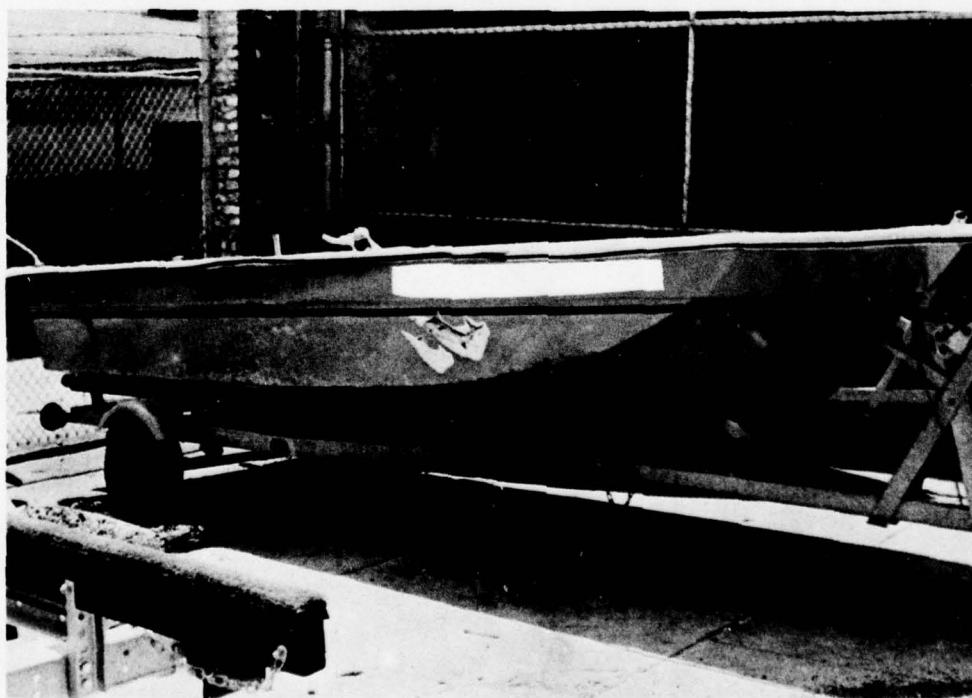


FIGURE 4

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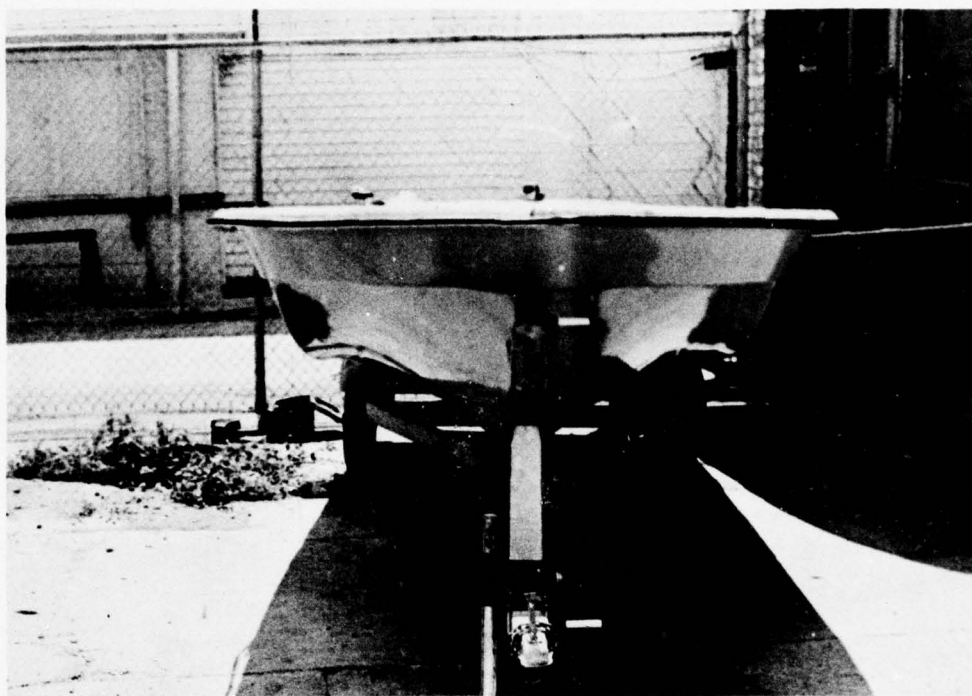


FIGURE 5

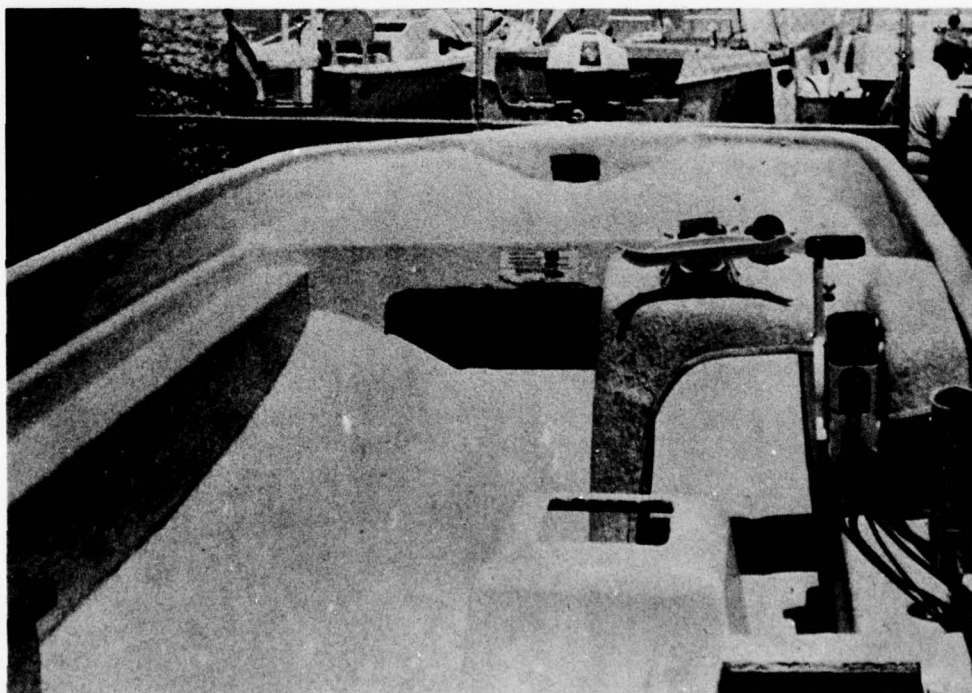


FIGURE 6

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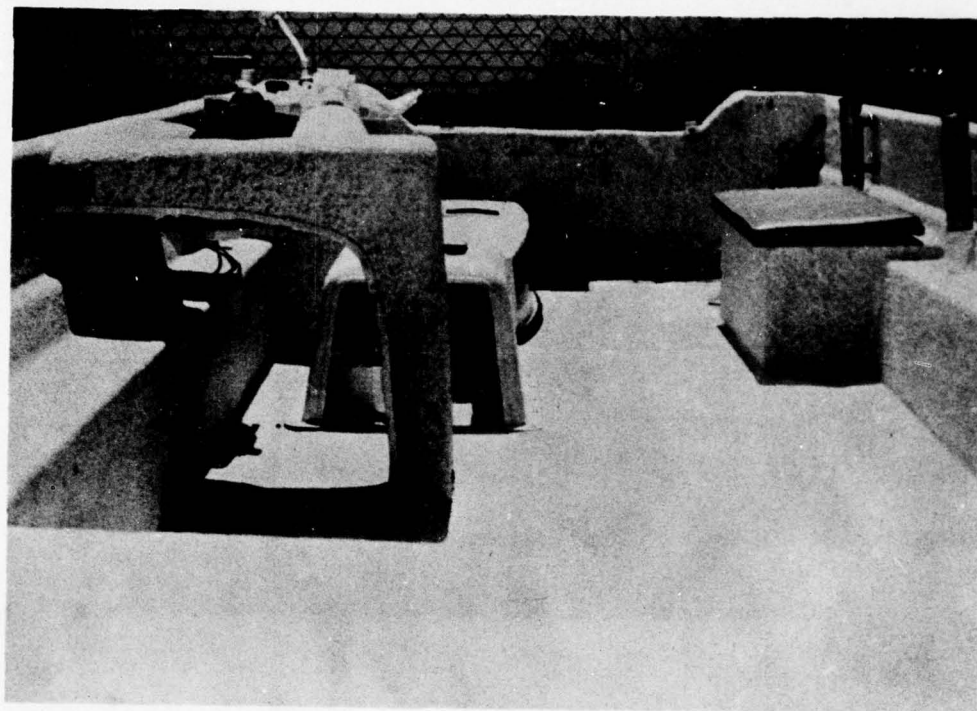


FIGURE 7

F-16

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## ACCIDENT INVESTIGATION REPORT

Date of Investigation: 26 August 1976

Date of Accident: 17 August 1976

Investigation: Capsizing/Swamping No. 76-07

### SUMMARY — WYLE ACCIDENT NO. 76-439

At approximately 1800 three women and two men were cruising in a 15 ft (4.6 m) fiberglass boat powered by a 55 horsepower Chrysler outboard motor. They were cruising at about five knots, running parallel to the shore and the oncoming waves. The operator of the boat was sitting on the back of the operator's seat, holding onto the steering wheel. When the operator let go of the steering wheel to light a cigarette, he lost his balance and fell overboard. None of the other occupants knew how to operate the boat, but one of them managed to head the boat toward shore and then turn the motor off. The boat was quite near the shore and soon drifted into the breaking surf. The operator, who had fallen overboard was walking toward the boat, as the water was only chest deep. Before he could reach the boat, waves broke into the boat, causing it to swamp. All the other occupants then jumped out of the boat into knee-deep water. The occupants then dewatered the boat, using a bucket they had with them, headed the boat into the waves, pushed it out, and climbed aboard. The engine stopped after starting, and the boat was again swamped and beached by the breaking waves. The Coast Guard was notified at this time and they came and pulled the boat off the beach and towed it to the Coast Guard station. There were no injuries, and all occupants were wearing PFDs.

## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Boating Instruction	PFDs Worn/Used	
							Before	After
Operator	M	27	175 (79.4 kg)	Fair	200-300 hr	None	Yes	Yes
Passenger 1	F	31	130 (59 kg)	Fair	< 20 hr	None	Yes	Yes
Passenger 2	F	33	145 (65.8 kg)	Fair	< 20 hr	None	Yes	Yes
Passenger 3	F	30	125 (56.7 kg)	Poor	20-100 hr	None	Yes	Yes
Passenger 4	M	38	98 (44.5 kg)	Fair	20-100 hr	None	Yes	Yes

The operator of the boat had been boating for approximately two years. The only boats he had operated in addition to the one involved in this accident were small johnboats. For the past two years he said he went out almost every weekend. Passengers 1 and 2 had only been boating a total of two times each, including this outing. Passengers 3 and 4 had been boating several times, but did not know how to operate a boat; they went out only as passengers.

## 2.0 ENVIRONMENT

Wind at the time of the accident was light to moderate. Air and water temperature as reported by the local USCG station was: air temperature 84°F (29°C) and water temperature 79°F (26°C). Wave height in the area of the accident was one to two ft (0.3 - 0.61 m). The boat was operating near shore, just beyond the point at which the waves began to break.

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

The following narrative was formulated from an interview with four of the occupants that were on board at the time of the accident.

#### 3.1 Pre-Accident

The operator of the boat had gone over to one of the occupants' house the day before the accident. All five of the occupants had been at the occupant's house the morning of the accident. They sat around talking for a good part of the day when the operator suggested that they go boating. All agreed that they would like to go boating and decided that they would go. It was approximately 1600 local time when they made the decision. The operator of the boat paid a friend of his to tow the boat to the launch area which was about eight miles (12.9 km) from the house where they were. All five of the boat occupants got into a car and drove to the launch area.

After arriving at the launch area, the operator filled a six gallon fuel tank with fuel, and also filled a spare five gallon can with fuel. The boat was then launched and all occupants boarded the boat and donned AK-1 type PFDs. Seating arrangement and boat loading were as shown in Figure 1.

They cruised for about an hour and a half on the mainland side of the offshore banks near Mason Inlet, North Carolina (see Figure 2). The operator then decided to go through the inlet into the ocean, as shown in Figure 2.

After being in the ocean for several minutes, three of the passengers said that they did not want to stay in the ocean, but wanted to return to the inlet and go back to the more protected water.

The operator turned the boat around and was proceeding parallel to the beach towards the inlet at about seven mph (11.3 kmph). He was sitting on the back of the operator's seat with his feet on the normal sitting area, steering the boat from that position.

### 3.2 Accident

The oncoming waves, which were one to two ft (0.3 - 0.61 m) high, were hitting the boat broadside, causing it to roll as it proceeded underway. The operator let go of the steering wheel to light a cigarette, and when the boat rolled due to the wave motion, he lost his balance and fell overboard.

None of the other occupants knew how to operate a boat, and were afraid that if they turned the boat around to go back to the operator in the water they might run over him. Passenger 1 turned the boat toward shore and shut the engine off. She said that she wanted the boat to stay in one spot, but it would not. The boat gradually drifted toward the beach as the operator walked toward the boat. The water was about chest deep, and he said that it was easier to walk than to swim, because the PFD hindered his swimming. Before the operator reached the boat, it had drifted into the area where the waves were breaking. Waves began to break into the boat as it hit the bottom. All the occupants then jumped out of the boat into the water which was approximately one ft (0.3 m) deep. The boat filled with water and washed up on the beach, but did not overturn. The occupants partially dewatered the boat with the help of two people who were on the shore, using the battery holder and a bucket, then turned the boat bow into the waves, boarded the boat, got the engine started, and proceeded out from shore. Before going very far, the engine died, possibly caused by the battery being shorted out from water that was still on board. The boat again washed ashore and all occupants jumped out.

### 3.3 Post Accident

One of the people on the beach who had helped dewater the boat saw what was happening and called the Coast Guard. The Coast Guard arrived at the scene in about 10 min. and shot a line to the occupants who were alongside the beached boat. They fastened the line to the boat, and the Coast Guard attempted to tow the boat off of the beach. The line broke as the Coast Guard began to pull the boat from the beach. The Coast Guard then shot a heavier line and this was fastened to the boat, and the boat was towed from the beach. The two people on the beach took all of the occupants to the Coast Guard station where they picked up the boat when it was towed in.

### 3.4 Time Sequence of Accident Events

Following is a time sequence of the events of the accident .

1600	Five occupants left the home of one of the occupants to go boating .
1615	They arrived at the launch site .
1630	The boat was fueled and launched .
1635	All occupants boarded the boat and donned AK-1 type PFDs .
1635-1745	The party of five cruised around in the area protected by off shore islands .
1750	They proceeded out of the inlet into the ocean .
1753	They turned around and headed back towards the inlet .
1754	The operator fell overboard .
1755	One of the passengers turned the boat towards shore and shut off the engine .
1756	The operator attempted to reach the boat as it was drifting towards shore into the breaking waves .
1757	The operator reached the boat as waves were breaking into it . All occupants jumped out of the boat .
1800	The occupants partially dewatered the boat with the aid of two people on the beach .
1810	The boat was pointed seaward, boarded, and the engine started .
1811	The engine stopped due to the battery being shorted out from water remaining in the boat .
1812	The boat was washed ashore again and all occupants jumped out .
1813	The Coast Guard was notified by the two people on the beach .
1823	The Coast Guard arrived on the scene .
1825	An attempt was made to tow the boat off the beach but the line broke .
1828	Another line was fastened to the boat, and it was towed from the beach .
1830	The two people on the beach that aided in the first dewatering took the occupants to the Coast Guard station where the boat was brought in at 2245 .

#### 4.0 VESSEL DATA

The operator of the boat had told the investigators that the boat would be available for inspection. When the investigators arrived on the scene, the boat was not available. The following information was obtained from the operator, who was not very familiar with terms that describe a boat, such as hull form, motor well, etc.

Capacity information was obtained from the Coast Guard boarding report. The make of boat was not legible on the report, and the operator who had borrowed the boat for the outing did not know the make of the boat.

Boat Length — 15 ft (4.6 m)

Boat Material — Fiberglass

Max. Weight Capacity — 1200 lb (544.3 kg)

Max. Persons Capacity — 750 lb (340.2 kg)

Max. HP — 75

Hull Type — Tri

No Motor Well

Cable Pulley Steering System

Engine — 1975 55 hp Chrysler Outboard

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator of the boat did not appear to be familiar with boats, even though he said he had been boating for two years. He said that the reason he was sitting on the back of the seat was to see over the windshield; another possible reason could have been that he was showing off in front of the three female occupants, who were not experienced boaters. The operator admitted to having three or four beers while they were boating. This could have contributed to his losing his balance when he let go of the steering wheel. The other occupants appeared to remain calm after the operator fell overboard, but had any of them known how to operate the boat, it would not have been shut off and allowed to drift into the breaking surf.

## 6.0 PROBABLE CAUSE OF ACCIDENT

There were a combination of accidents involved in this accident scenario. The first was a fall overboard caused by one or more, probably a combination, of the following:

- Poor helmstation design, causing the operator to sit on top of the back of the seat to see over the windshield.
- A bit of showing off by the male operator in front of three female passengers.
- Inattentiveness on the part of the operator.
- Loss of equilibrium caused by wave motion and having drunk several beers.

The initial swamping was caused by turning the boat off and allowing it to drift into the surf. Having no one on board that knew how to operate the boat was the cause of this.

The second swamping was caused by trying to operate a boat that still had water in it in the breaking surf.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The first accident that occurred was a fall overboard. The operator of the boat was sitting on the back of the seat, which generally is not a very secure position. Waves were hitting the boat broadside, causing it to roll, adding to the insecurity of the seat back sitting position. Several beers having been drunk added to the instability of the operator. When he let go of the steering wheel, he lost his balance, primarily due to the roll motion of the boat, and fell overboard.

The occupants of the boat, wanting to "keep the boat in one place near the operator," shut the boat off. They were not aware that the oncoming waves and light wind would carry them into the breaking surf and onto the beach. At the time, however, this appeared to be the best thing to do, since no one in the boat knew how to operate it. The boat drifted into the breaking surf, allowing the breaking waves to break over the transom and swamp the boat.

Attempting to negotiate the breaking surf in a boat which had free water remaining in it from the first swamping was not a wise thing to do. The water shorted out the battery, causing the engine to stop, and thus allowing the oncoming waves to once again break into the boat, filling it with water.

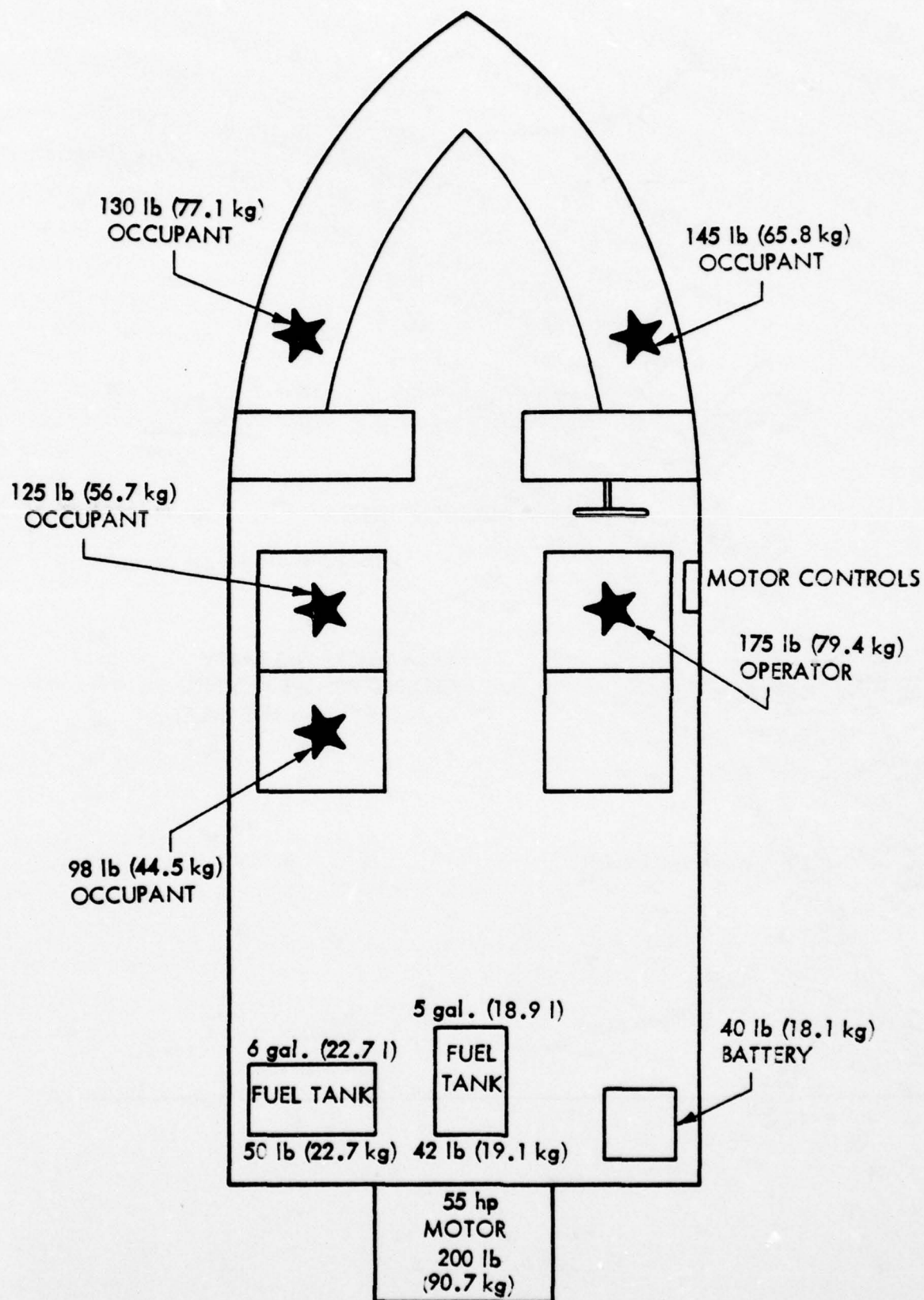


FIGURE 1. BOAT LOADING CONFIGURATION  
G-9



## ACCIDENT INVESTIGATION REPORT

Date of Investigation: August 28, 1976

Date of Accident: July 13, 1976

Investigation: Capsizing/Swamping No. 76-08

### SUMMARY — WYLE ACCIDENT NO. 76-343

At approximately 0800 on July 13, 1976, one man set out in his 12 ft (3.7 m) fiberglass Sears Gamefisher on a fishing/cruising trip. His home and place of launch of the boat was on the water in an area protected by offshore islands. He trolled along the inland side of the islands, specifically Shackleford Banks off the coast of North Carolina. When he reached the end of the banks, he decided to go to the ocean side of the banks for the return trip to his home. He stopped fishing, went into the ocean, and proceeded back in the direction toward his house. As he proceeded along the ocean side of the banks, the oncoming swells from the ocean began to get larger, reaching a height of three to five ft (0.9 - 1.5 m). As he proceeded along the banks, a wave would occasionally crest and break just offshore. The operator allowed his boat to get too close to shore, and one of the breakers capsized his boat. He managed to right the boat and swim with it to shore. After he beached the boat, he walked for several miles to phone for help, and then returned to his boat. The Coast Guard arrived on the scene shortly and had the operator taken to the hospital, because he appeared to be totally exhausted. The boat was towed to the Coast Guard Station, and the operator was examined and released from the hospital.

## 1.0 OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn/Used</u>	
							<u>Before</u>	<u>After</u>
Operator	M	69	165 lb (74.8 kg)	Good	>500 hr	None	No	No

The owner/operator of the boat lived on the water front for over 30 years. During this time, he had owned several small boats. He purchased his present boat in June, 1976. During the summer months he went out fishing about twice a week, usually with another person on board. The area where he usually operated his boat was generally within sight of his house, so he was quite familiar with the area.

## 2.0 ENVIRONMENT

The weather was clear with a strong wind of 15-25 mph (24.1 - 40.2 kph) blowing. Seas were calm on the leeward side of the outer banks, where the occupant launched his boat. There were swells which continued to build to three to five ft (0.9 - 1.5 m) on the ocean side of the banks to where the operator had proceeded just prior to capsize. Water temperature was 70°F (21°C) and air temperature was 85°F (29°C).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

The following narrative was formulated from an interview with the owner/operator of the involved boat.

#### 3.1 Pre-Accident

The owner of the boat was semi-retired, working at an ABC store two or three days a week. He did not work the day of the accident, but got up at his usual time which was 0700. After having breakfast, he decided to go out and do some fishing. He kept his boat suspended over the water from launching/retrieving davits, which were located at the dock adjacent to his waterfront home (Figure 1). Equipment on board consisted of a six horsepower outboard motor, a fuel tank, tool chest, paddle, jug of water, anchor, one PFD, and a fishing pole (Figure 2). The operator lowered his boat into the water, climbed aboard, started the engine, and proceeded from his dock to the mainland side of Shackleford Banks (Figure 1). He fished along the inside of the banks, heading toward the east side of the banks. When he reached the end of the banks near Barden Inlet, he decided to stop fishing and return home by way of the outer side of the banks. He proceeded through the inlet out to the ocean side of the banks and began to head west, following the banks toward Beaufort Inlet. He said there were no swells at first, but when he got about halfway to Beaufort Inlet, swells began to form. As he proceeded toward the inlet, the waves began to increase in size and would occasionally break near shore. He had seen three or four wakes break ahead of him in the vicinity of where he was heading.

#### 3.2 Accident

The operator thought that he was far enough off shore to avoid the breakers. When he reached the area where he had first seen the breakers, he realized that he was too close to shore (about 80 ft (24.4 m)) and that he could possibly get caught by a breaking wave. Before he could move further off shore, a single wave crested and broke just as it reached his boat. The wave hit the boat broadside, causing it to capsize port over starboard at the location marked in Figure 1.

### 3.3 Post Accident

The operator surfaced within reach of the boat and grabbed it. He managed to right the boat and hold onto the gunwale near the bow. He stayed with the boat, holding to it, and swimming with it while it was slowly washed toward shore by the waves. When he reached the beach, he left the boat to go for help. The nearest houses were approximately two miles (3.2 km) from where he landed on the beach, and he walked/ran to one of them where he telephoned the Coast Guard and told them what had happened. He then walked/ran back to his boat where the Coast Guard found him totally exhausted. They had him taken to the hospital where he was examined and then released. The Coast Guard pulled his boat off the beach and towed it back to the Coast Guard Station where the owner picked it up.

### 3.4 Time Sequence of Accident Events

0700	Operator awakened and ate breakfast.
0745	Operator readied boat for fishing trip.
0800	Boat was launched and fishing trip began.
0915	Arrived at Barden Inlet without incident.
0916	Proceeded through inlet into ocean.
0920	Began to encounter swells.
0925	Saw swells cresting and breaking.
0930	Breaking wave capsized boat.
0931	Operator righted boat and hung onto it.
0940	Boat and operator were beached by waves.
0940-1020	Operator went for help to nearest house (approximately two miles (3.2 km)).
1025	Operator notified Coast Guard of accident.
1026-1115	Operator returned to boat where he was found by Coast Guard and sent to hospital.

#### 4.0 VESSEL DATA

Manufacturer:	Sears Model Gamefisher
Model Year:	1976
Length Overall:	12 ft 1 in. (3.7 m)
Max. Beam at Gunwale:	49-1/2 in. (1.3 m)
Max. Beam at Chine:	41-3/4 in. (1.1 m)
Max. Transom Width:	46 in. (1.2 m)
Transom Height:	17 in. (0.4 m)
Depth Amidships:	18 in. (0.5 m)
Max. Horsepower Cap.:	10
Max. Weight Capacity:	545 lb (247.2 kg)
Max. Persons Capacity:	405 lb (183.7 kg)
Hull Type:	Semi-V
Hull Material:	Molded Fiberglass

Figure 3 shows the overall layout of the boat.

Horsepower On Board:	Manufacturer — Evinrude
	Rated Horsepower — 6

Model Year — 1976

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator was quite familiar with the area in which the accident occurred. He said that the cause of the accident was poor judgment on his part, in getting too close to shore and not realizing it. The investigator tends to think that this was the major contributing factor. To substantiate the fact that his judgment was poor at times, the following incident is presented. The operator of the boat picked up the investigator at the airport and returned him to the airport after the interview. On the return trip while making a turn into the airport parking lot, he (the operator of the boat) ran his car into a drainage ditch beside the driveway. It was not a deep ditch and there was no damage done, but it did show inattention or poor judgment (depth perception) on the part of the operator.

## 6.0 PROBABLE CAUSE OF ACCIDENT

This accident was caused primarily by operating a small boat in an area that was known to have large breaking waves. Operating the boat broadside to the waves was also a major contributing factor. Poor judgment on the part of the operator caused the boat to be operated in this area, resulting in the capsizing of his boat.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The load in the boat was less than the maximum allowable capacity displayed on the capacity plate. Improper load placement could have contributed to the capsize. The operator was sitting slightly to starboard of centerline while operating the boat with his left hand. Successive waves hitting the boat broadside could have caused the fuel tank to shift to starboard, increasing the heeling moment to starboard. A breaking wave hitting the boat broadside, on the high side could have relatively easily caused the load to shift further, causing the boat to capsize. Even if the load had been distributed about the centerline so there was no heeling moment, a breaking wave hitting a boat of this size broadside could have relatively easily caused it to capsize.

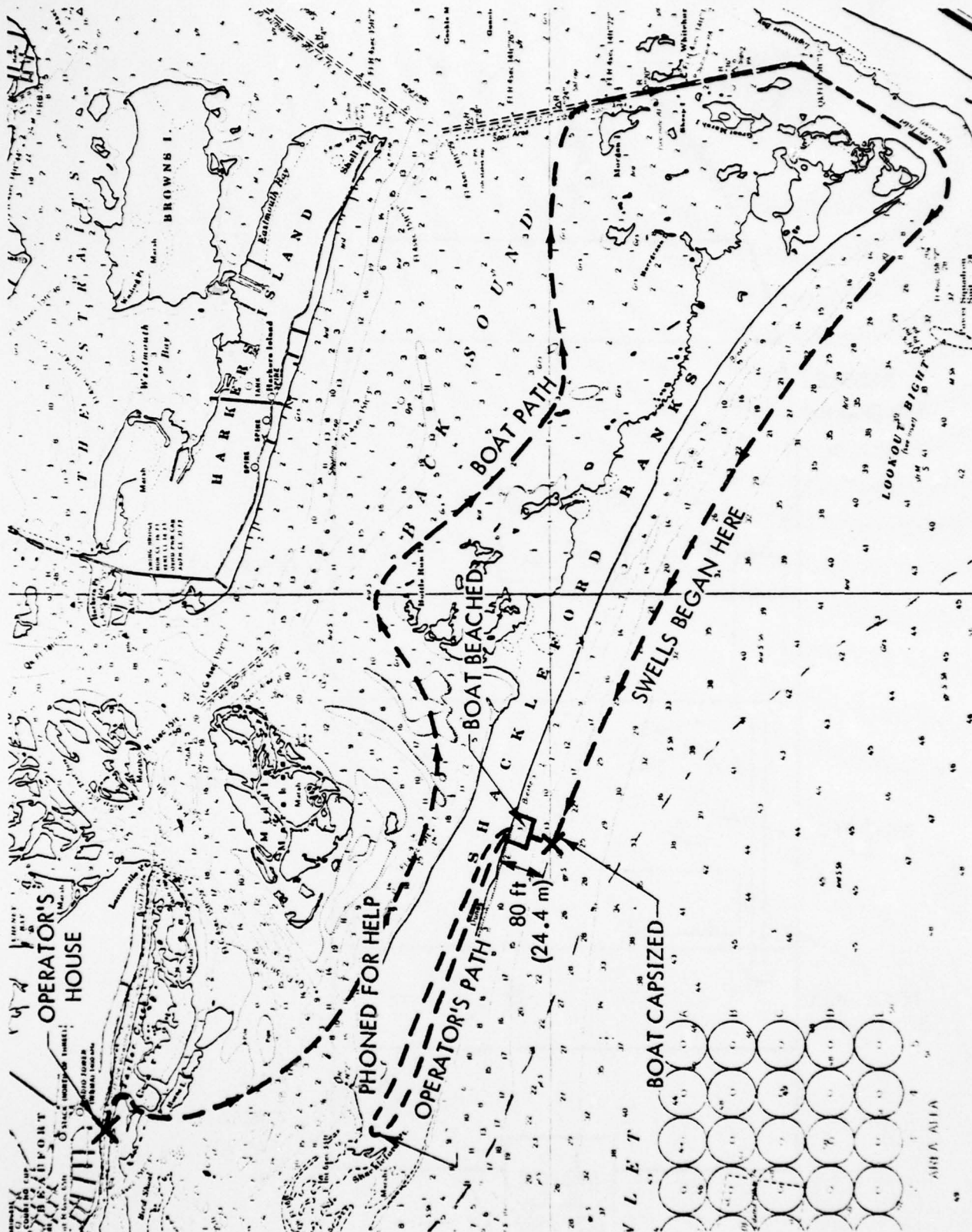


FIGURE 1. SKETCH OF ACCIDENT AREA

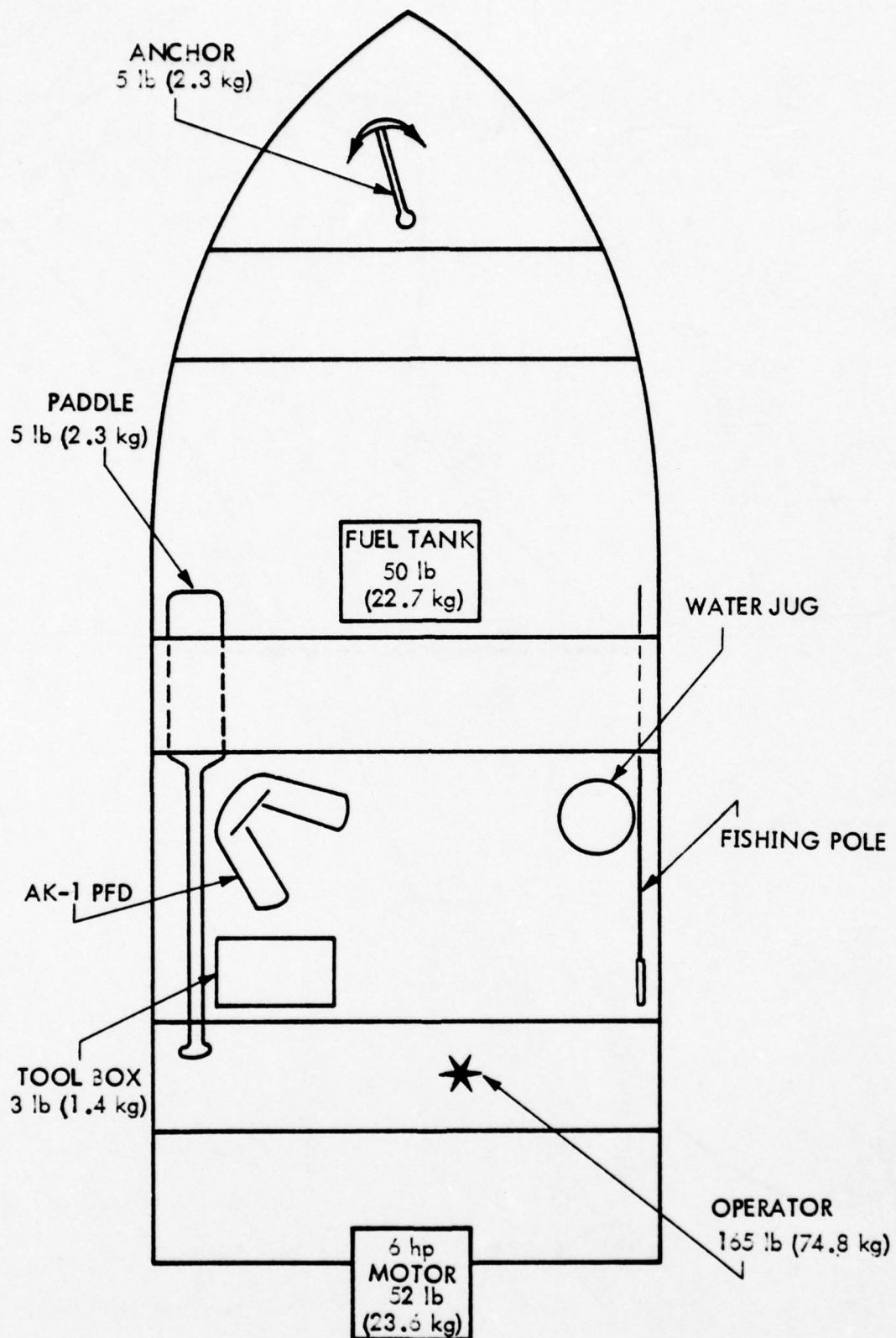


FIGURE 2. WEIGHT DISTRIBUTION PRIOR TO ACCIDENT

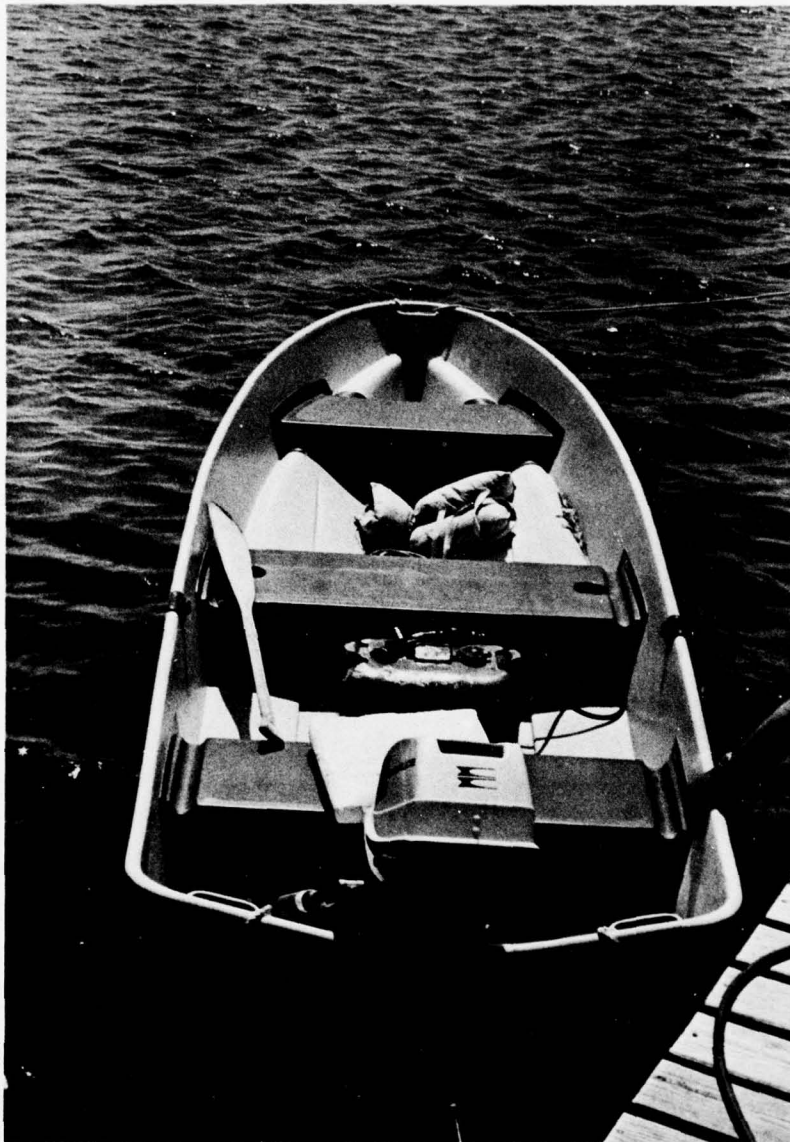


FIGURE 3. OVERALL VIEW OF ACCIDENT BOAT

H-9/10

129  
130X

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: August 31, 1976

Date of Accident: August 22, 1976

Investigation: Capsizing/Swamping No. 76-09

### SUMMARY — WYLE ACCIDENT NO. 76-480

The accident reported herein involved a 14 ft 2 in. (4.3 m) tri-hull bass boat with stick steering powered by a 40 horsepower motor. The type of accident was a fall overboard of the two occupants aboard, resulting in serious leg injuries to the operator.

At approximately 0930 on August 22, 1976, a man and his wife set out on a fishing trip from a launch ramp located near Charlestown, N. C. After getting underway, the couple played out their fishing lines behind the boat to free the reels that had become entangled during storage. After freeing the reels, the lines were wound in, and the operator applied full throttle accelerating to approximately 36 mph (57.9 kph). Shortly after obtaining full speed, something happened to cause the boat to turn sharply to starboard, throwing the occupants out of the boat over the port side. The boat made a wide circle to starboard, returning to the location of the occupants. The operator swam a few yards and grabbed the starboard side of the moving boat, and the passenger grabbed the port side. The operator reached over the starboard side and turned off the ignition which stopped the motor. The operator boarded the boat and noticed that his leg had been badly cut by the prop when he was thrown out of the boat. He helped

his wife aboard, and she restarted the boat and drove it back to the launch ramp. The operator was hospitalized within an hour after the accident. The passenger was not injured.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn</u>	
							<u>Before</u>	<u>After</u>
Operator	M	24	148 lb (67 kg)	Excellent	> 200 hr	None	No	No
Passenger	F	23	148 lb (67 kg)	Good	< 25 hr	None	No	No

### 1.1 Owner/Operator

He was a S/Sgt. in the U. S. Air Force and worked as a crew chief on a large military aircraft. He seemed to be of average intelligence and physical ability. His parents owned small runabout pleasure boats, and he had learned to operate a boat at an early age. He had owned and operated a 12 ft (3.7 m) aluminum semi-V hull boat for five years. He had owned and operated the involved boat for approximately three months. He seemed to possess an average knowledge concerning small boat operations. He was relatively inexperienced in operating a boat equipped with stick steering.

### 1.2 Passenger

She worked as a nurse in a local hospital and seemed to be of average intelligence and physical ability. Her boating experience consisted of accompanying the operator on outings in the 12 ft (3.7 m) aluminum involved boat over a two year period prior to the accident. The operator had taught her the fundamentals of small boat operations and on occasion let her operate the boats. She had learned how to start, get the involved boat underway, and control the heading (stick steering) at a slow speed.

## 2.0 ENVIRONMENT

The sky was clear and the visibility was good. The wind was light and variable, and the water was calm. The estimated air temperature was 80°F (27°C), and the estimated water temperature was 75°F (24°C). The tide was incoming (near high tide) with little or no current.

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

On the night before the accident, the operator (1) had been on standby duty at his military unit. He had worked a 24 hr shift and was scheduled to be off duty for 48 hrs. During the 24 hr shift, he had no tasks to perform and was able to receive a normal amount of sleep. (1) and his wife (Passenger 2) had planned a fishing trip when he completed his shift. (1) got off duty at 0800 on August 22, 1976 and arrived at his home at approximately 0830. The fishing gear was loaded in the boat, the boat/trailer attached to (1)'s automobile, and the couple departed for the launch ramp approximately 20 miles (32 km) away at approximately 0845. They arrived at the launch ramp at approximately 0925 and launched the boat. They got underway toward the fishing area approximately four miles (6.4 km) from the ramp at approximately 0930. The fishing lines on the couple's rods and reels had become entangled around the reels since the last time they were used. They decided to play their lines out behind the boat and straightened out the lines before they reached the fishing area. They left the ramp at idle speed and maintained that speed until the lines were played out, untangled, and reeled back in, and the rods were stowed.

#### 3.2 Accident

Gear aboard was as shown in Figure 1 and the weather as noted in Section 2.0.

(1) applied full throttle, getting the boat on plane and accelerating to a speed of approximately 36 mph (57.9 kph). Shortly after obtaining full speed, (1) stated that the stick steering lever suddenly went forward, causing the boat to turn sharply to starboard. (1) also stated that as the lever went forward, the plastic ball on the tip came off in his hand. As the boat turned, the port chine dug in, causing (1) and (2) to be thrown out of the boat over the port side.

### 3.3 Post Accident

After (1) entered the water, he felt something bump his right knee which he thought was the stern of the boat. (2) did not remember being thrown out of the boat. She jokingly commented that she suddenly found herself in the water and thought that (1) "had thrown her out of the boat." (2) surfaced immediately and could feel (1) with her feet beneath her. She observed that the boat was headed back toward the launch ramp and toward a weed bank on the north side of the canal. She watched the boat swing in a wide arc, through the weed bank, and back toward her position. (1) did not know that (2) had touched him with her feet and did not know she had been thrown from the boat. He purposefully remained under water for approximately 10 seconds, because he could hear the boat motor noise and feared the boat could hit him if he surfaced. He surfaced when he was sure the boat was going away from his position. When he surfaced, the boat was in a stable, starboard turn back toward him. At this point he noticed he still had the stick steering ball in his hand, which he discarded. He quickly estimated the boat's turning radius and swam a few yards to a position he felt the boat would pass. He did not see (2) in the boat and decided she had been thrown overboard. As the boat passed, he grabbed the starboard gunwale near the throttle/shift control and held to the gunwale until he could reach over the side and turn off the ignition.

NOTE: The operator stated that the boat was going full speed when he grabbed the gunwale. It is unlikely that he could have grabbed and held to the gunwale if the boat speed had been 36 mph (57.9 kph). The investigators agreed that the boat speed was probably 15 mph (24.1 kph) or less. The passenger also stated that she felt the boat speed was considerably less than maximum.

A few seconds after (1) grabbed the gunwale, the boat came within reach of (2). She grabbed the port stern gunwale and held on until (1) turned off the ignition and the boat stopped. From the time (1) grabbed the boat until the motor was stopped was less than five seconds. After the boat stopped, (1) climbed over the starboard side into the boat. By this time he had heard (2) and knew she was on the port side of the boat.

After (1) entered the boat, he noticed that his right leg in the knee area was seriously injured. He could tell by the deep diagonal lacerations that his leg had been cut by the propeller. What he had thought was a bump from the boat hull had actually been the propeller hitting his leg. (2) was unable to climb into the boat and called to (1) for help. (1) helped her over the port gunwale into the boat. (2) could see that the cuts on (1)'s leg were deep and knew he would have to have medical treatment as soon as possible. She rendered first aid, went to the helm, started the motor, and started back to the launch ramp with (1) seated on the deck in the aft section of the boat. (2) was proceeding back to the ramp at approximately 10 mph (16.1 kph). (1) instructed her to go faster, but she replied that she was not sure she could control the boat at a faster speed and continued at the same slow speed. Shortly before reaching the ramp, (2) saw a small runabout boat approaching. She shouted to the occupants of the runabout that her husband was injured and she needed help when she reached the ramp. The runabout followed to the ramp where (1) was removed and taken to the local Naval hospital. At the time of the investigation, he was still hospitalized. See Figure 2 for sketch of accident area.

#### 3.4 Time Sequence of Accident Events

0800	Operator completed work shift.
0830	Operator arrived at home.
0845	Couple left home for launch ramp.
0925	Arrived at launch ramp and launched boat.
0930-0935	Traveled at idle speed toward fishing area, untangling fishing lines.
0935	Applied full throttle and accelerated to 40 mph (64.4 kph).
0936	Stick steering lever went forward, boat turned to starboard, throwing occupants out of boat.
0936-0937	Occupants observed boat traveling in wide arc and returning to their location.
0937	Operator and passenger grabbed boat, and operator turned off ignition.
0937-0939	Operator boarded boat and helped passenger aboard.
0939-0945	Boat returned to launch ramp and operator was taken to the hospital.

#### 4.0 VESSEL DATA

The involved boat was a 1975 model fiberglass tri-hull bass boat manufactured by Tom Boy Co. The boat was powered by a 1975 model 40 horsepower outboard motor manufactured by Mercury. A Morse stick steering system and a Mercury single lever throttle/gear control were installed on the boat. According to the operator, the Tom Boy dealer in Charlotte, N. C. where the boat was purchased installed the motor, steering system, and motor controls. The dealer had also installed a 1/8 in. (0.3 cm) aluminum reinforcement plate on the transom. The operator stated that he had returned the boat three times to the dealer for adjustment of the steering system. The steering system was tight as though it was binding, and the boat pulled to starboard underway. It is apparent upon examination of the boat that the steering cable transom bracket had previously been mounted too low (note old hole pattern below bracket in Figure 3). The initial bracket location would have most likely caused the steering cable to bind in the housing, particularly when the front of the motor was pulled to the port side. The last time the operator returned the boat for steering system problems, the dealer moved the transom steering cable bracket up approximately three in. (7.6 cm) (see Figure 3). The operator stated that after this modification, the steering system operated freely; however, the boat still pulled to the right when underway. At the time of the investigation, the trim tab on the lower unit was positioned at or near the zero trim location. Ordinarily an outboard boat would pull to the right with the trim tab in this position, assuming the steering was rigged correctly and the weight distribution was proper. Addition data obtained during the investigation are as follows:

H.I.N. — TBB44325M75

Model No. — S55

Maximum Beam Gunwale — 61-3/4 in. (1.6 m)

Maximum Beam Chine — 43 in. (1.1 m)

Maximum Transom Width — 63 in. (1.6 m)

Maximum Horsepower — 35

Maximum Persons Capacity — 600 lbs (272 kg)

Maximum Weight Capacity — 750 lbs (340 kg)

Transom Height — 20 in. (0.5 m)

Refer to Figures 4, 5, and 6 for overall boat views, and Figure 7 for transom and motor view.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator was an experienced boat operator but had very little experience in operating a boat equipped with stick steering. He had learned by experience that controlling a boat with stick steering was more difficult to master than conventional wheel steering. He felt he could safely control the involved boat, but did not feel he had mastered the technique of stick steering control. He had been told that stick steering systems were more likely to fail than conventional systems, which made him somewhat apprehensive when operating the involved boat at full speed.

The operator stated that when he grabbed the boat, it was going full speed, which is unlikely. He also stated that he reached across the boat and grabbed the stick and straightened the boat before he turned off the ignition, which is unlikely. It is the opinion of the investigators that the operator was disoriented when the boat turned sharply and actually does not remember specific details after that point.

## 6.0 PROBABLE CAUSE OF ACCIDENT

Inexperience with stick steering on the part of the operator is certainly considered a contributing factor. The following items are discussed as possible causes or contributing factors in this accident.

- The lower motor unit could have struck a submerged object at an angle that could have caused the boat to turn. However, no evidence on the lower unit or propeller could be found to support this theory.
- The trim tab on the lower unit could have shifted, causing the boat to turn. The trim tab was secured and could not be turned by hand; therefore, this is not considered the cause.
- The boat pulled to the right, which required the operator to exert a constant backward force on the control stick to maintain a straight course. If the plastic ball on top of the control stick came off in the operator's hand, the stick would have quickly gone forward, which would have put the boat in a sharp right

turn. The control stick was bent aft which would strongly indicate that the stick went forward and hit the deck with enough force to cause the bend. It is very unlikely that the operator could have exerted sufficient rearward force on the steering stick to cause the deformation. This is considered a likely factor in causing this accident. Refer to Figure 8 for deformed steering stick and Figure 9 for plastic ball location.

- The operator could have simply lost control, allowing the boat to get in a sharp starboard turn. However, according to the passenger, the boat was maintaining a straight course with no instability until she was thrown overboard.

Considering the statements of the occupants and the deformation of the steering lever, it is the opinion of the investigators that the accident was caused by a material failure in the steering system. Whether the inexperience of the operator prevented him from reacting to the emergency situation properly is unknown.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The boat entered a hard turn to starboard and, due to the hull design, began to skid to the outside of the turn. As the turn continued, the skidding action caused the keel to ride up over the bow wake. The boat then rolled to port (tripped), and the port chine dug in, causing the skidding motion to abruptly stop. Sufficient momentum had been generated in the turn, so that when the lateral motion of the boat was stopped, the momentum of the occupants caused them to be thrown out of the boat on the port side. The operator stated that he always kept his hand on the throttle when traveling full speed. Seated in the normal operating position (see Figure 10), the normal reaction of the operator would be to hold to the throttle for support when being thrown over the port side. The throttle position for full speed is down and forward; therefore, if the operator held to the throttle, the force exerted would cause the lever to come up and aft, reducing the engine rpm. This would account for the slower speed the boat was traveling after the occupants were thrown overboard. Figure 10 shows the stick steering position for zero motor angle after the accident. Figure 11 shows the approximate normal zero motor angle position prior to the accident.

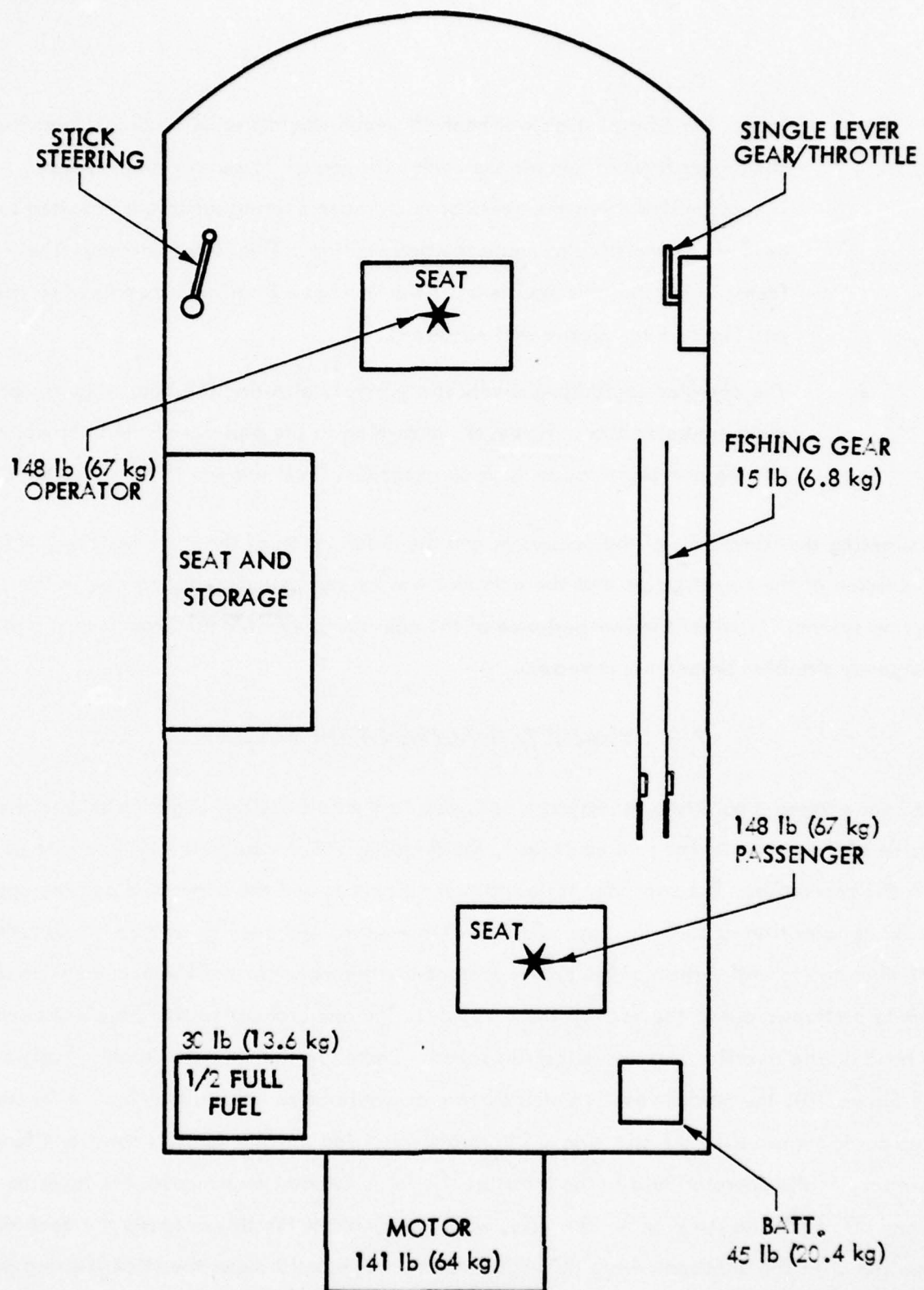


FIGURE 1. BOAT LOAD DISTRIBUTION AT TIME OF ACCIDENT

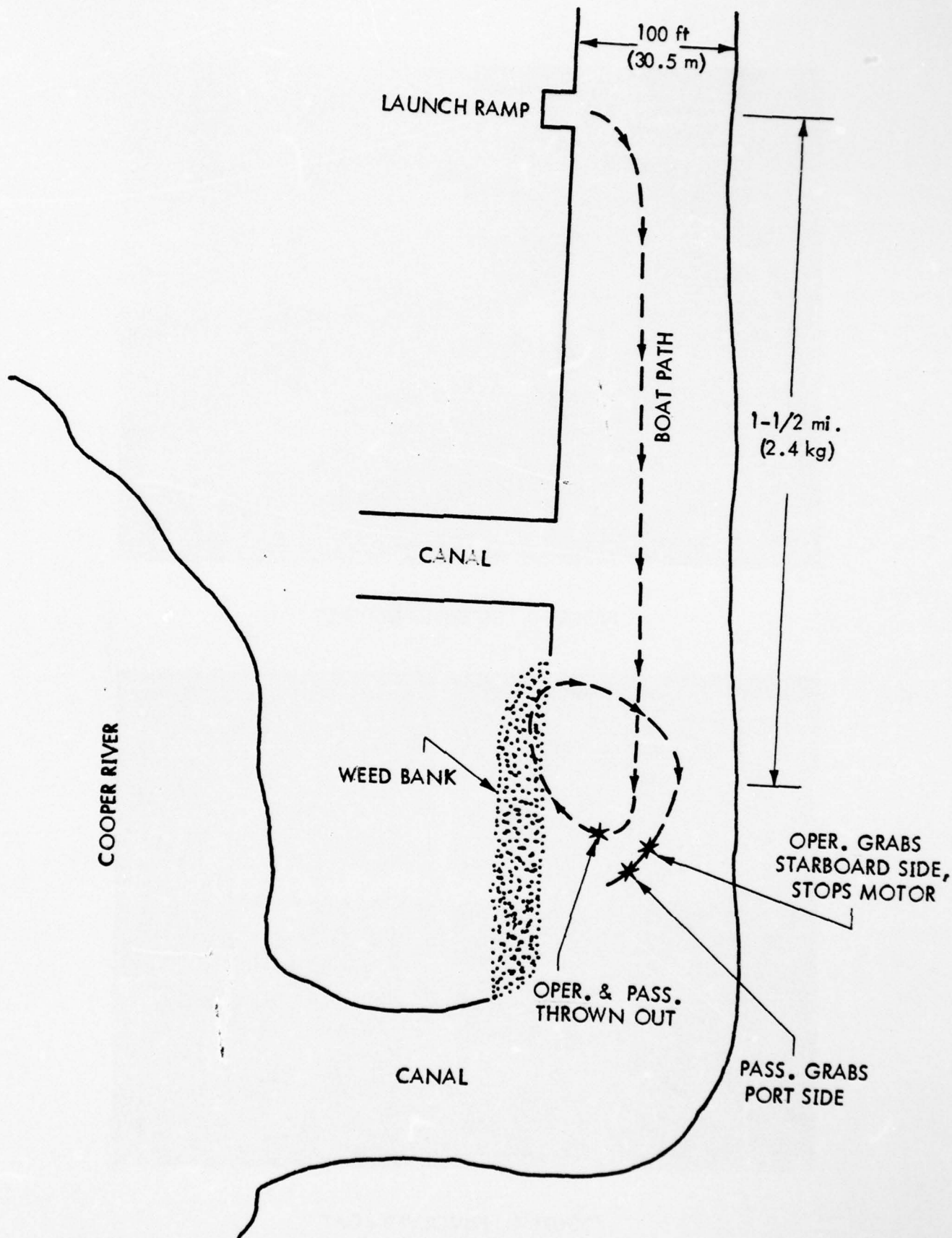


FIGURE 2. SKETCH OF ACCIDENT AREA

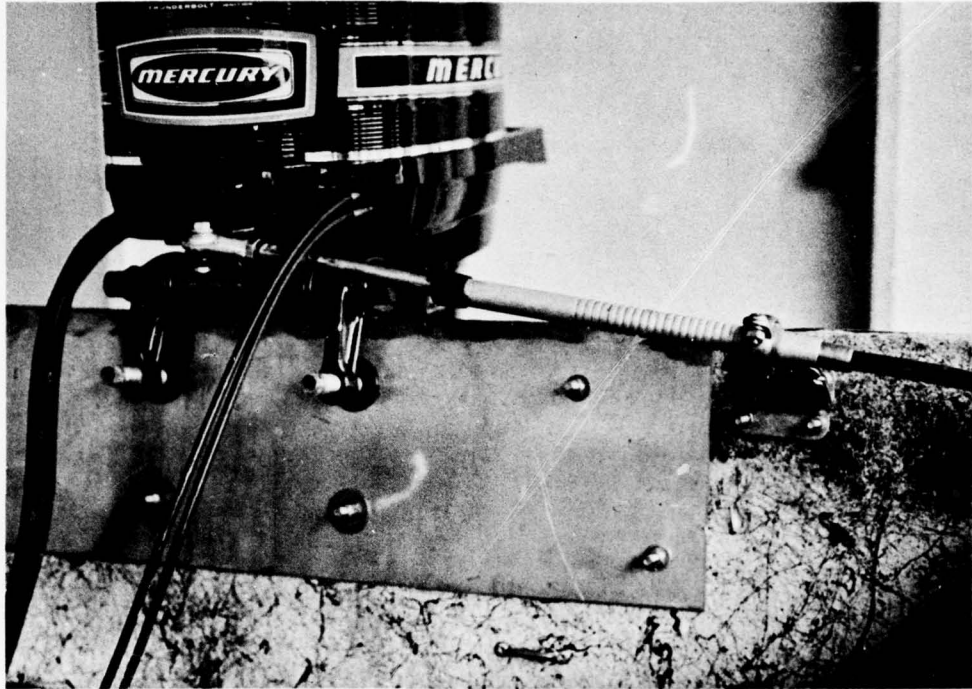


FIGURE 3. STEERING BRACKET

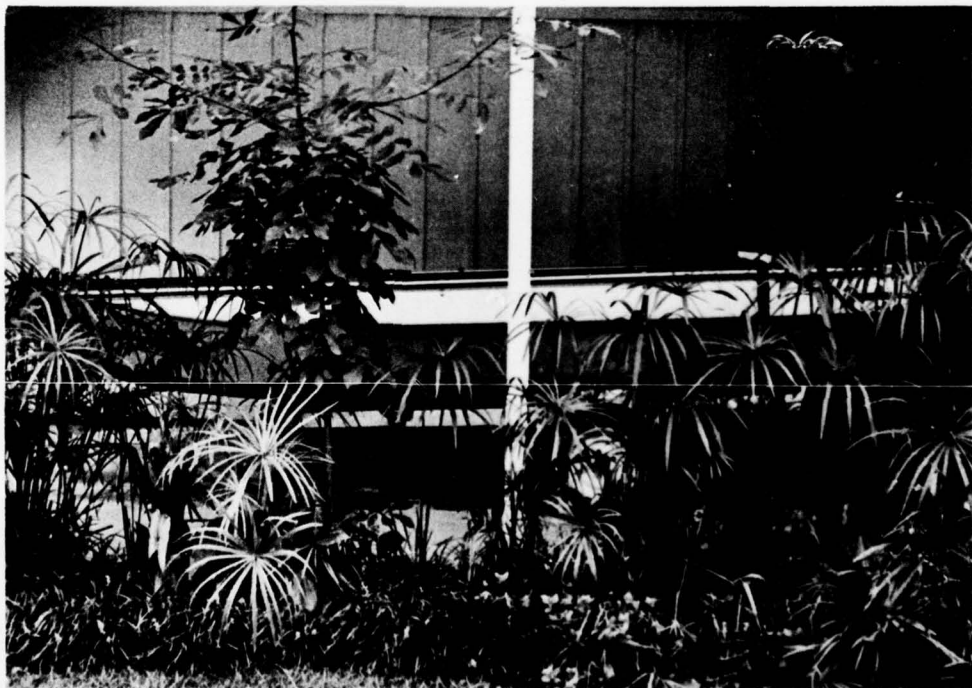


FIGURE 4. INVOLVED BOAT

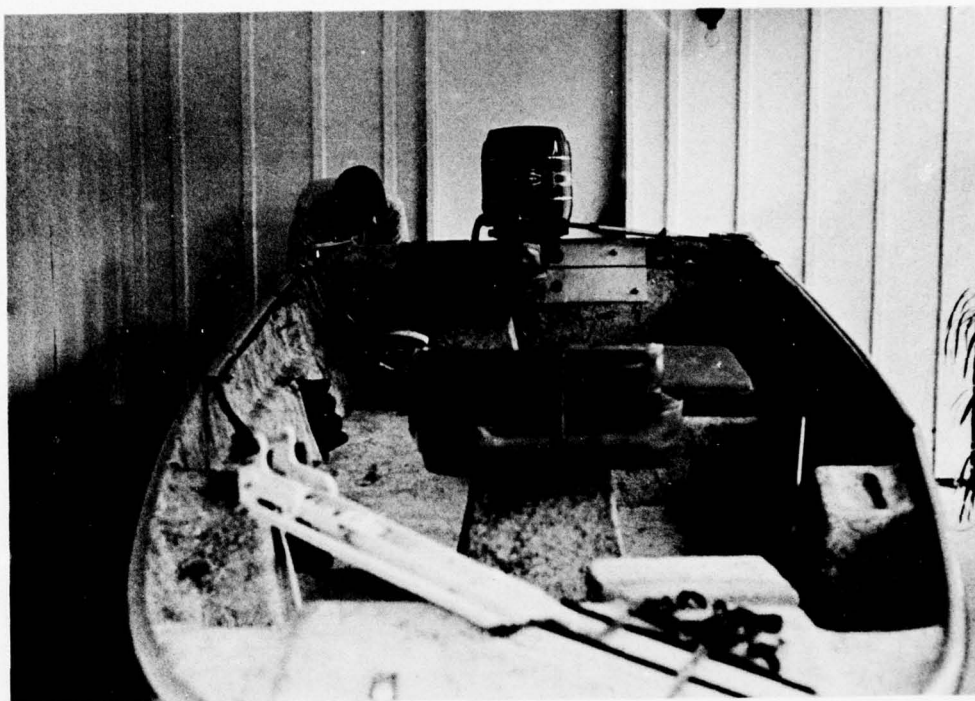


FIGURE 5. INVOLVED BOAT



FIGURE 6. INVOLVED BOAT



FIGURE 7. TRANSOM AND MOTOR



FIGURE 8. DEFORMED STEERING STICK

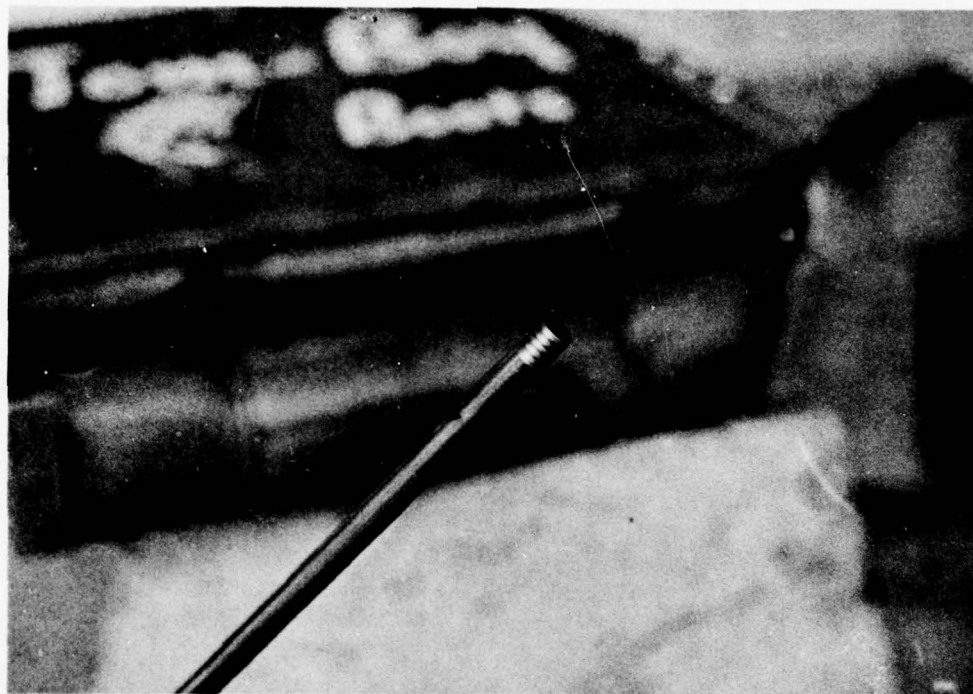


FIGURE 9. PLASTIC BALL LOCATION



FIGURE 10. STICK STEERING POSITION FOR ZERO MOTOR ANGLE AFTER ACCIDENT



FIGURE 11. APPROXIMATE NORMAL ZERO MOTOR ANGLE PRIOR TO ACCIDENT

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: September 23, 1976

Date of Accident: August 21, 1976

Investigation: Capsizing/Swamping No. 76-10

### SUMMARY — WYLE ACCIDENT NO. 76-550

The accident reported herein involved a 13 ft 10 in. (4.2 m) flatbottom aluminum johnboat powered by a 15 horsepower outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1450 on August 21, 1976, an adult male and two 11 year old boys set out on a fishing trip from a private dock located on the Ogeechee River near Savannah, Georgia. The operator of the boat was the 11 year old son of the boat owner. The passengers were an uncle and a cousin. The party traveled approximately one mile (1.6 km) down the river at a speed of approximately 15 mph (24 kph). The boat was slowed to idle speed, and the occupants started preparing their fishing equipment for trolling. Before the fishing lines were cast out, a large commercial trawler was observed coming up the river at approximately 20 mph (32 kph). As the trawler passed, the operator of the involved boat noticed that the wake was very high and turned the bow of his boat into the wake to avoid being swamped. The boat rode over the wake without taking on any water. After the boat was inside the wake, the operator decided to go back through the wake to a fishing area near the shore. The bow rode up over the first wave, then sliced bow first into the second wave, completely swamping the boat. The 11 year

old passenger panicked, stood up, put his foot on the port gunwale, and jumped overboard and swam approximately 50 ft (15.2 m) to shore. When he jumped overboard, his weight on the port side caused the boat to capsize, dumping the operator and adult passenger over the port side.

The operator and adult passenger stayed with the capsized boat until rescued by relatives who were in a small boat nearby. The involved boat was righted and towed back to the private dock.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn/Used</u>	
							<u>Before</u>	<u>After</u>
(1) Operator	M	11	118 lb (53.5 kg)	Good	100-300 hr	None	No	Yes
(2) Passenger	M	55	185 lb (83.9 kg)	Fair	>500 hr	None	No	No
(3) Passenger	M	11	90 lb (40.8 kg)	Good	None	None	No	No

### 1.1 Operator

He was a grade school student and seemed to be of average intelligence and physical ability. It was obvious from the interview that he was considerably more knowledgeable concerning boat operations than most individuals his age. He had been taught to operate a boat by his father who had owned and operated small boats for the past 20 years. The owner's residence was on the Ogeechee River and the operator had been permitted to operate the involved boat in the river in the vicinity of his home over the past three years. He and a friend had spent the summer vacation of 1976 fishing in the river from the involved boat and selling the fish they caught to a local fish market.

### 1.2 Passengers

Both passengers were relatives from another state and had been visiting the owner at the time of the accident. The owner of the involved boat stated that the two passengers were of normal intelligence and physical ability. The adult passenger had owned and operated numerous small runabout boats during the past 30 years but had very little experience in operating a small johnboat. The 11 year old passenger had never operated any type boat.

## 2.0 ENVIRONMENT

The sky was clear and the visibility was excellent. The water was calm with a slow current, and the wind was light. The estimated air temperature was 85°F (29°C), and the estimated water temperature was 75°F (24°C). The water depth at the accident site was approximately 15 ft (4.6 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

On the day of the accident, the owner of the involved boat was having a family reunion/picnic at his residence on the Ogeechee River near Savannah, Georgia. At approximately 1430 the owner's son (Operator (1)), his brother-in-law (Passenger (2)), and his nephew (Passenger (3)) decided to go on a fishing trip on the river. The outboard motor and fuel tank were placed on the involved boat which was tied off in the water alongside the owner's private dock. Fishing gear was loaded aboard, and the party got underway down the river at approximately 1450, destined for a fishing spot approximately one mile (1.6 km) from the dock. Traveling at a speed of 10-15 mph (16-24 kph), the party arrived at the fishing area at approximately 1455. The motor was slowed to idle rpm, and the occupants started preparing their rods and reels for trolling. They planned to troll up and down the river near the mouth of a small canal. While the fishing gear was being prepared, (1) noticed a large commercial trawler coming up the river toward the involved boat at a fast rate of speed (approximately 20 mph (32 kph)). As the vessel approached, (1) observed that it was generating a very large wake, and its heading would cause it to pass approximately 50 ft (15.2 m) off the starboard side of his boat. The location of the involved boat at this time was approximately 50 ft (15.2 m) from shore. As the vessel passed, (1) turned the bow of the involved boat into the oncoming waves to avoid being swamped. He instructed the passengers to hold on, because the wake was going to be rough. (1), seated at the operator position on the starboard side, held to the steering arm and the starboard gunwale. (2) assumed a squatting position in front of the center seat and held to the gunwales. (3), seated on the center seat, port side, held to the seat and the port gunwale. (1) maneuvered the boat through the wake at idle speed without taking on any water.

#### 3.2 Accident

Gear and people aboard were as shown in Figure 1 and the weather as noted in Section 2.0.

Immediately after getting inside the wake, (1) decided to turn around and go back through the wake to a position near the mouth of the canal. The boat rode up over the first wave, and the bow abruptly slammed down into the valley. The bow sliced into the second wave, completely swamping the boat. After swamping, the boat remained upright and level. (3) apparently panicked, jumped out of the boat, and swam approximately 50 ft (15.2 m) to shore. As (3) exited the boat, he placed his foot on the port gunwale, causing the boat to roll to port. As the boat rolled, (1) and (2) were thrown out over the port side. The boat continued to roll until it was in an upside down, near level position.

### 3.3 Post Accident

(1) grabbed a life cushion that had floated out of the boat, and (2) grabbed an AK-1 PFD, which he soon discovered would not support him. He discarded the AK-1 and grabbed a cooler which was within reach.

Note: During the investigation, the AK-1 was visually inspected by the investigators. The upper bag had been punctured or had ruptured, and the capok material was saturated with water.

(1) climbed on top of the overturned boat and removed his shoes and pants. He then re-entered the water on the opposite side from (2), and the two started swimming with the boat toward shore. (1) held to the port side and the life cushion, and (2) held to the starboard side and the cooler. The anchor had fallen out of the boat when it overturned and after moving a few yards, the anchor line became tight. With considerable effort (1) and (2) managed to get the boat near shore with the anchor dragging.

The three occupants of the involved boat were rescued by relatives who were pleasure boat riding in the accident area and had witnessed the capsizing. The involved boat was righted and towed back to the owner's dock.

Refer to Figures 2, 3, and 4 for accident area.

### 3.4 Time Sequence of Accident Events

- 1450 Left dock for fishing area.
- 1455 Arrived at fishing area and started preparing fishing equipment for trolling.
- 1457 Large vessel observed, coming up river.
- 1459-1500 Involved boat crossed wake to inside, turned around, and started crossing wake to outside toward shore.
- 1500 Boat rode over wave into valley and swamped.
- 1500-1501 Passenger (3) jumped overboard, capsizing boat.
- 1501-1505 (1) and (2) swam with boat to shallow water.
- 1505-1530 Occupants rescued and boat towed to dock.

### 4.0 VESSEL DATA

The boat was a 1974 Fisher Marine, Model No. 1418-2 powered by a 1975 15 horsepower Evinrude outboard motor. The hull was a typical flatbottom of riveted/welded aluminum construction. The length overall was 166 in. (4.2 m) with a maximum beam at gunwale of 54.5 in. (1.4 m) and a transom width of 53.5 in. (1.4 m). The capacity plate specified a maximum weight capacity of 740 lbs (335.7 kg), a maximum persons capacity of 540 lbs (244.9 kg), and a maximum horsepower capacity of 20. Styrofoam flotation material was factory installed under the aft and center seats. The boat appeared to be in good condition and no modifications had been made.

Refer to Figures 5-8 for overall boat views and Figure 9 for the outboard motor installed on the involved boat at the time of the accident.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

It was apparent from the interview that the operator was a typical 11 year old boy with above average boating experience. During the investigation, the interviewers observed him operating the involved boat in the river near his residence. The manner in which he maneuvered and docked the boat showed that he was an experienced operator, particularly in the involved boat.

He exercised poor judgment in going back through the large wake after he had safely maneuvered the boat inside the wake. However, this is not considered an unusual action for an 11 year old boy. Getting the boat safely through the wake was probably exciting and he no doubt felt that going back through the wake would be equally exciting. A more mature person would have most likely avoided the wake completely or would have stayed inside the wake until the waves dissipated. The adult passenger was inexperienced concerning johnboats and was unable to assess and advise the young operator of a dangerous situation.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- Poor judgment on the part of the operator to avoid the wake and his decision to go back out through the wake once safely inside is considered the major contributing factor. He could have easily avoided the wake by maneuvering the boat to a nearby canal.
- Unsafe operating procedures on the part of the commercial vessel operator created the conditions that caused the accident. According to the occupants of the involved boat, the large vessel operator waved at them as he passed; therefore, it is felt he had sufficient time to reduce his speed or maneuver to a safe distance prior to passing the involved boat.

26/10

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The following is presented, based on the narrative and knowledge of the boat characteristics.

According to the estimated weight in the boat at the time of the accident, the boat was not overloaded. The load distribution was such that the boat was most likely running essentially in a level attitude at idle speed. When the boat rode up over the wave, the bow dropped into the valley with sufficient force to reduce the bow freeboard to near zero. The forward momentum of the boat then carried the bow into the next wave. The reduced bow freeboard allowed water to flow freely over the bow, completely swamping the boat. With the flotation material installed low in the boat and the center of gravity of the weight in the boat at a much higher level, the boat had a natural tendency to capsize when flooded. Passenger (2) stepped on the port gunwale when jumping out of the boat. His weight produced a sufficient roll moment to capsize the boat. After the boat was upside-down, the flotation material provided sufficient buoyancy to keep the boat afloat with (1) and (2) holding to the sides.

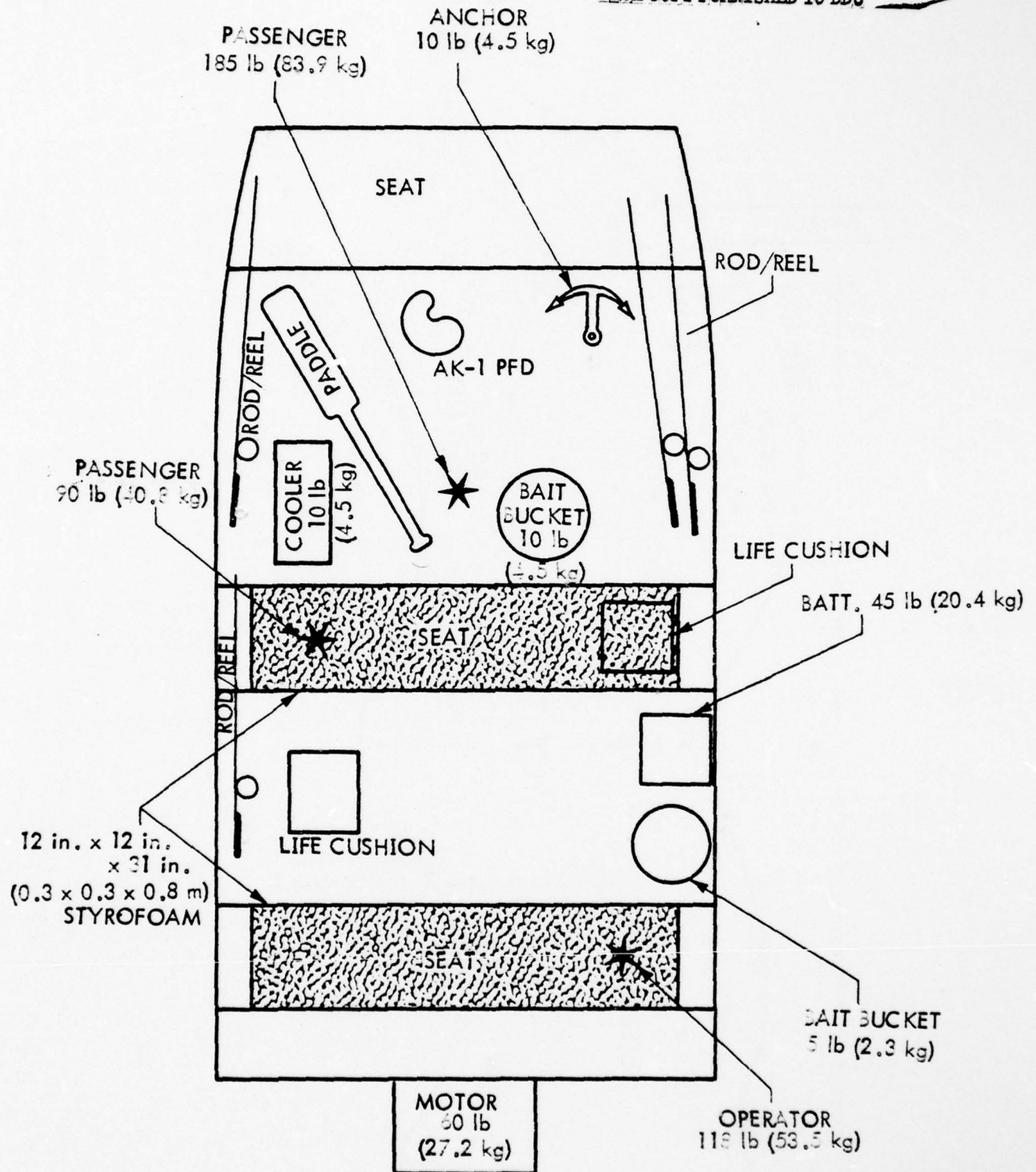


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

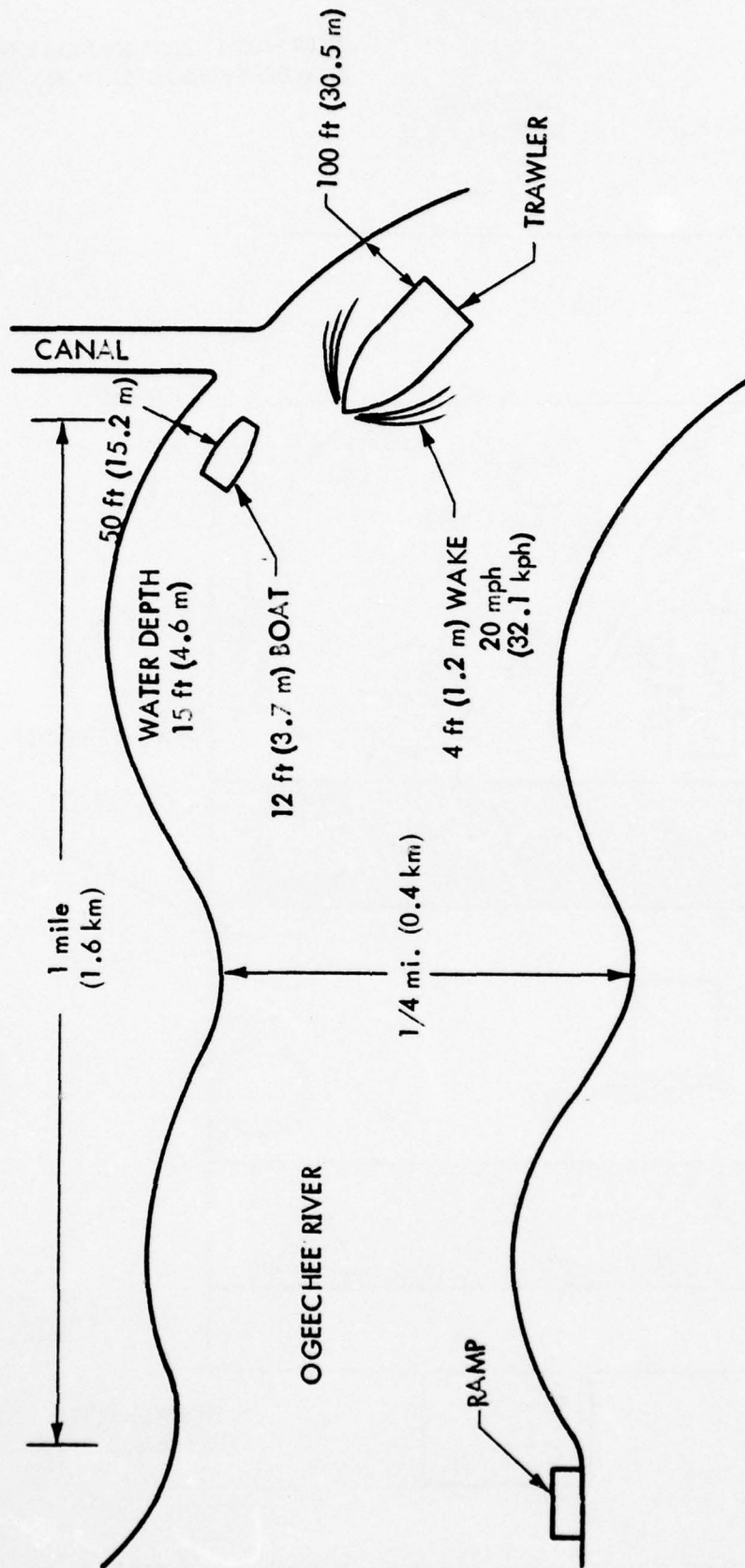


FIGURE 2. SKETCH OF ACCIDENT AREA

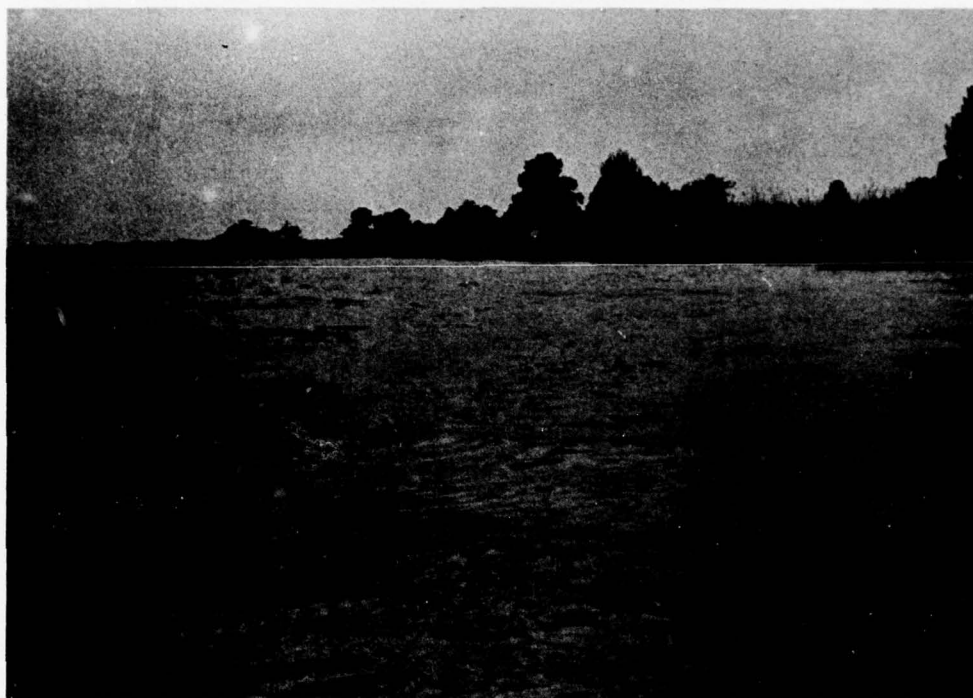


FIGURE 3. ACCIDENT AREA

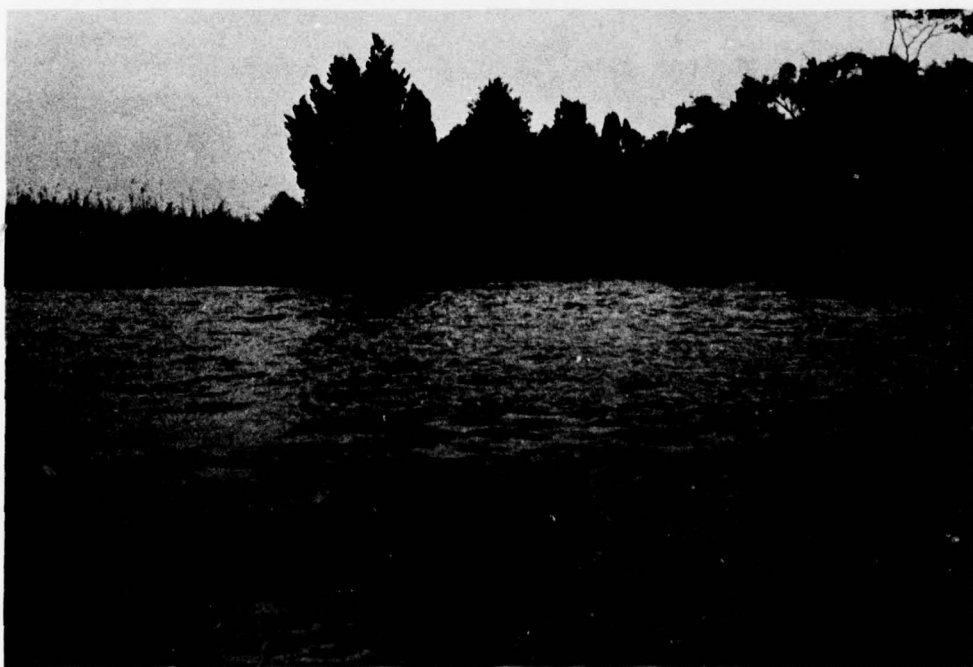


FIGURE 4. ACCIDENT AREA

J-11

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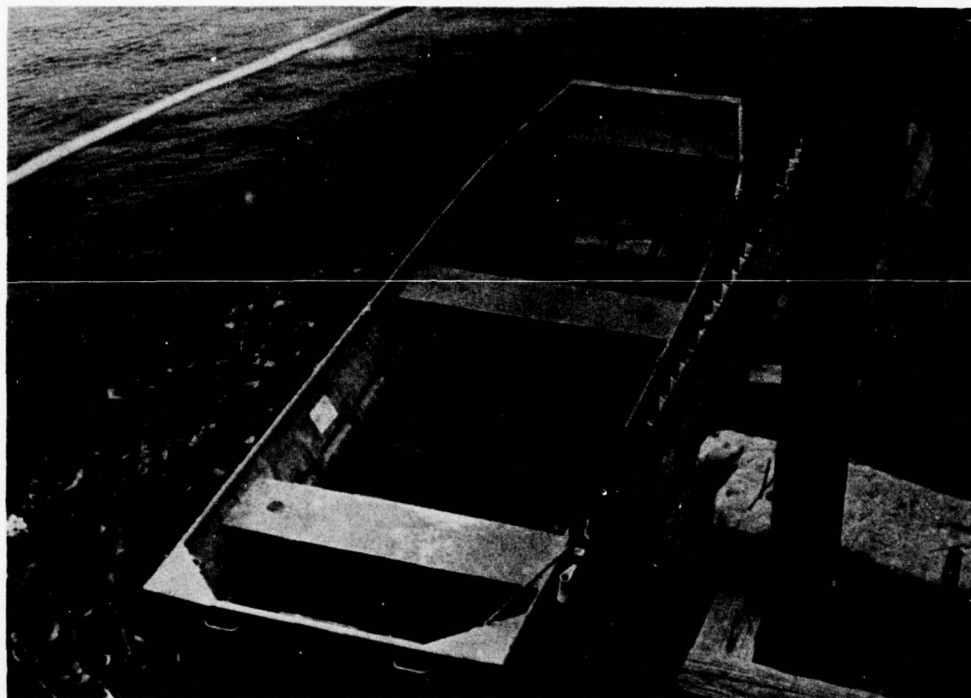


FIGURE 5. INVOLVED BOAT

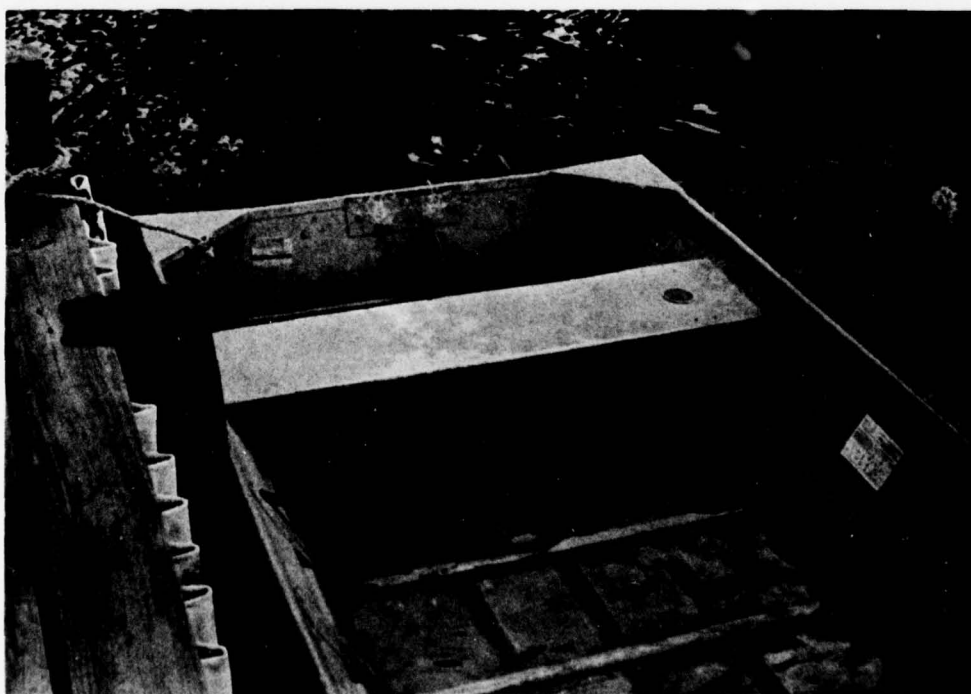


FIGURE 6. INVOLVED BOAT

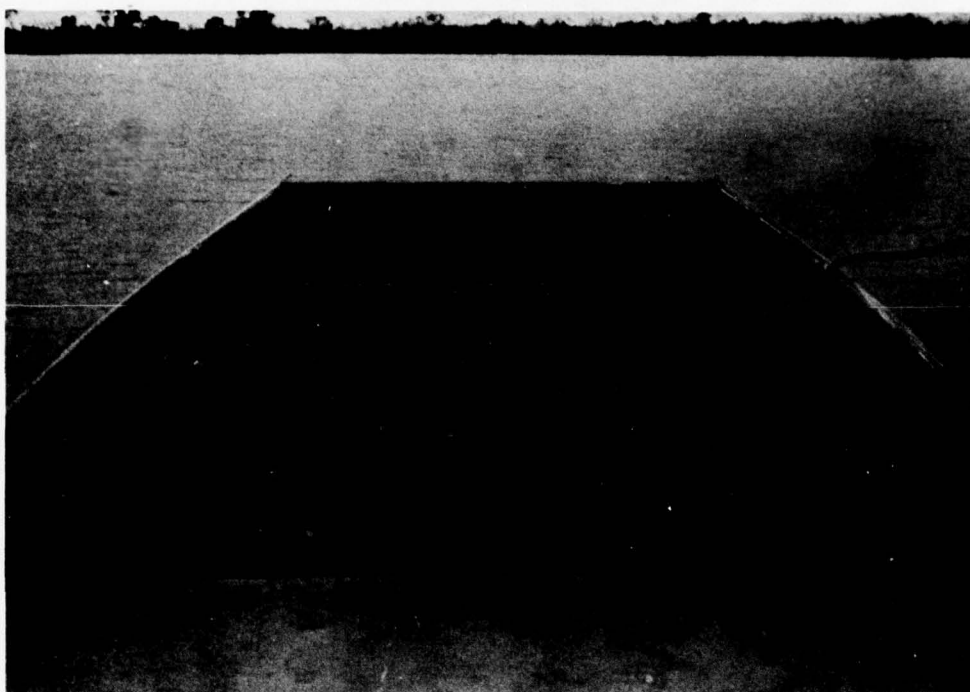


FIGURE 7. INVOLVED BOAT

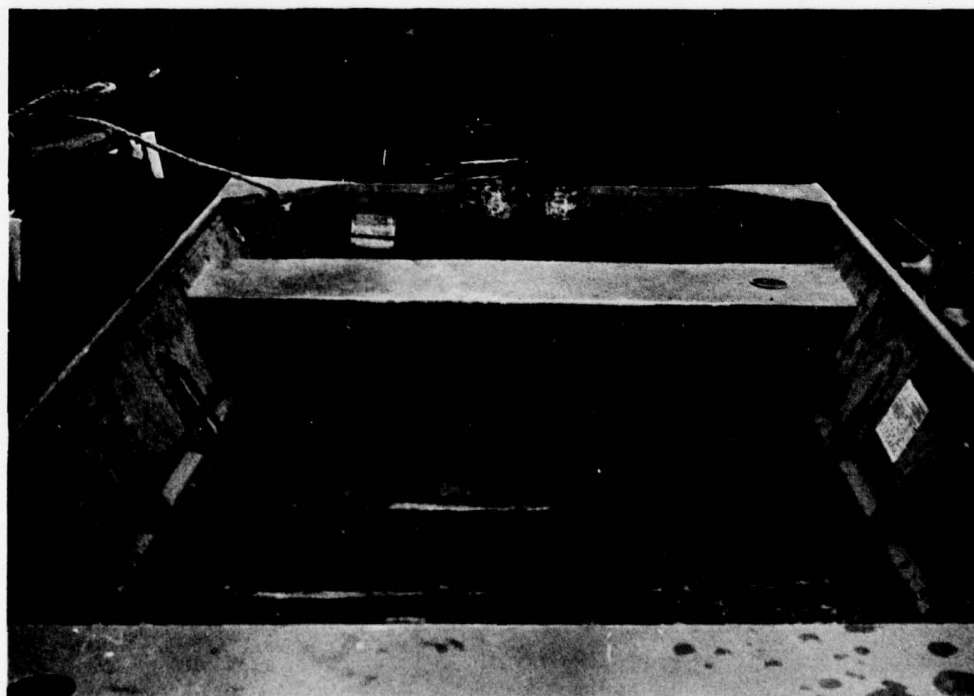


FIGURE 8. INVOLVED BOAT

J-13

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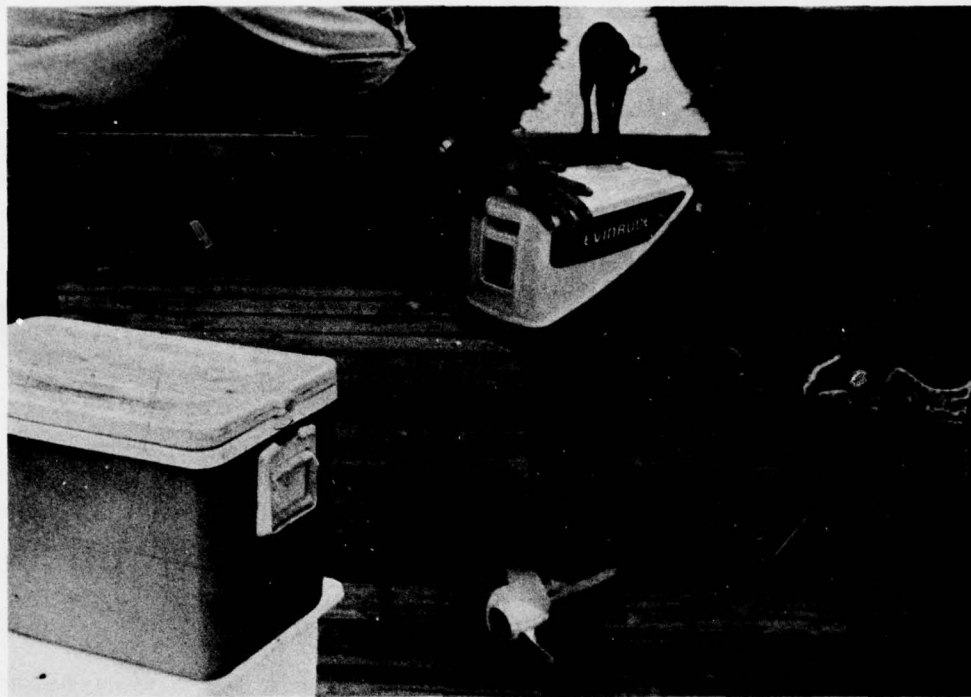


FIGURE 9. OUTBOARD MOTOR

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: 24 September 1976

Date of Accident: 11 July 1976

Investigation: Capsizing/Swamping No. 76-11

### SUMMARY - WYLE ACCIDENT NO. 76-323

The accident reported herein involved a 17 ft 11 in. (5.5 m) semi-V bowrider powered by a 135 horsepower outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in the drowning of one of the six people aboard and the near drowning of a second person aboard.

At approximately 1600 on 11 July 1976 three adults and three children on the involved boat were returning from a fishing trip on Pamlico Sound in east central North Carolina. The party had been drift fishing with two other small boats in an area approximately 10 mi (16 km) off shore since 0930. During the day the wind velocity had increased from approximately five knots to approximately 15 knots and wave heights had increased from 2 ft to 4 ft (0.6 m to 1.2 m). The boat was located approximately eight miles (12.9 km) from the launch area and was traveling at a speed of approximately 10 mph (16 kph). The operator noticed that the boat seemed very heavy and the bow was almost submerging when the boat went over a wave and the bow went into the valley. He slowed the boat to approximately 5 mph (8 kph) to negotiate the waves. Shortly after slowing down, the bow sliced into a wave swamping the forward section of the boat. All the occupants moved aft to increase the bow freeboard. A wave then broke over the transom

completely swamping the boat. The motor stopped from water intake, the boat turned and was capsized by a wave hitting broadside. Four of the occupants stayed with the boat until rescued by one of the other boats in the party. Unknown to the four occupants and the crew of the rescue boat, an adult female and a 9 year old female had been trapped under the boat when it capsized. Both occupants under the boat were wearing AK-1 PFDs. The rescue boat searched the accident area for the two missing persons for approximately 15 minutes. The rescue boat then left the accident site toward the marina to alert Coast Guard search and rescue. On the way to the marina a commercial fishing vessel with a marine radio was spotted and stopped. The Coast Guard was called by radio and dispatched a helicopter and rescue boat to the accident area. The Coast Guard Auxiliary was also notified and dispatched a rescue boat. The helicopter located the capsized boat and hovered in the area until it was low on fuel. The helicopter then dropped a flare and left the scene. The Coast Guard and Coast Guard Auxiliary rescue boats located the capsized boat by heading toward the flare. The two rescue vessels were not equipped to raise the capsized boat. A commercial trawler with hoisting equipment was contacted and arrived on the scene approximately four hours after the accident. The boat was hoisted aboard the trawler. When the boat was raised the two occupants were discovered and taken out of the water. Attempts to revive the 9 year old were unsuccessful. The adult was revived in approximately 15 minutes. The adult had lost consciousness from lack of oxygen. The 9 year old had apparently lost consciousness from lack of oxygen and drowned. The adult had her legs through the steering wheel which probably prevented her from drowning.

## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Boating Instruction	PFDs Worn/Used	
							Before	After
Operator 1	M	35	245 lb (111.1 kg)	Poor	100 hr	None	No	No
Passenger 2	M	46	175 lb ( 79.4 kg)	Good	500 hr	USCG	No	No
Passenger 3	M	11	95 lb ( 43.1 kg)	Fair	None	None	Yes	Yes
Passenger 4	F	35	120 lb ( 54.4 kg)	None	None	None	Yes	Yes
Passenger 5	M	12	130 lb ( 59.0 kg)	Good	None	None	Yes	Yes
Passenger 6	F	9	80 lb ( 36.3 kg)	Good	None	None	Yes	Yes

### 1.1 Owner/Operator

He owned and operated a combination supermarket, service station, and western clothing and equipment shop. He seemed to be of average intelligence and physical ability. He admittedly was not an experienced operator. He had owned two boats during the past three years, but did not go out in them very often. He usually went fishing with Passenger (2) who was a more experienced operator. He had owned the involved boat for approximately 1-1/2 years.

### 1.2 Passenger (2)

It was apparent from the interview that he was much more experienced than the operator. He had owned and operated small boats for the past 20 years. He seemed to be of average intelligence and physical ability. He provided most of the details associated with the accident due to the emotional state of the operator. The deceased was the daughter of the operator.

### 1.3 Passengers 3, 4, 5 and 6

These passengers were all inexperienced boat operators. All of their time in a small boat had been as passengers. They were considered to be of normal intelligence and physical ability.

### 2.0 ENVIRONMENT

At the beginning of the trip the sky was partially clouded and the visibility was good. The wind was from the west at approximately five mph (8 kph) and the water conditions were 1-1/2 ft to 2 ft (0.46 m to 0.6 m) rolling swells. The air temperature was estimated to be 85°F (29° C) and the water temperature was estimated at 72°F (22° C). At the time of the accident, the wind had increased to approximately 15 mph (24.1 kph) and the rolling swells had increased to approximately four ft (1.2 m). The water depth at the accident site was approximately 25 ft (7.6 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

During the week preceding the accident the owner/operator and an adult male friend had planned a fishing trip for Sunday, July 11, 1976. On the night before the accident the operator and all passengers went to bed early. On the day of the accident, the operator and passengers arose at 0600 and ate breakfast. All the supplies except the coolers had been loaded aboard the boat on the previous day. Also, the boat/trailer had been connected to the operator's automobile and the boat fuel tank had been topped off.

The fishing party included the operator (1), an adult male friend (2), the friend's son (3), operator's wife (4), operator's son (5) and operator's daughter (6). Occupants (2) and (3) arrived at the operator's home at approximately 0630 and the coolers were loaded aboard the boat. The party left for Paradise Shore Marina approximately 75 miles (120.7 km) away at approximately 0645.

They arrived at the marina and launched the involved boat at approximately 0900. The party had fished in Pamlico Sound before but did not know the best fishing locations. The operator asked the marina operator where they should go. He was informed that a local fisherman who was very familiar with the area was going out shortly and could show them a good area. The operator talked to the fisherman and was told he would lead them to a good area along with another party that was not familiar with the area.

The three boats got underway to the fishing area approximately 10 miles (16.1 km) out in the sound at approximately 0930. After reaching the area, the occupants of the three boats drift-fished in the area until approximately 1545. During the day the six occupants of the involved boat ate sandwiches and drank soft drinks. At approximately 1545 the three boats headed back toward the marina. The wave heights had increased to approximately four ft (1.2 m) and the boats were only able to run at approximately 10 mph (16.1 kph) to safely negotiate the waves. After getting underway toward the marina, the operator noticed that his boat seemed heavier and more sluggish than normal and was not taking the waves very well.

The bow and stern freeboard was decreasing to two inch - three inch (5 cm - 7 cm) as the boat negotiated the waves. Approximately 15 minutes after getting underway, the operator commented to his friend that he would have to slow down to prevent being flooded. He then decreased the boat speed to approximately five mph (8 kph).

### 3.2 Accident

Gear aboard was as shown in Figure 1 and the weather as noted in Section 2.0.

Shortly after reducing speed, the boat rode over a wave, the bow dropped into the valley and sliced into the next wave swamping the forward passenger compartment. The operator put the motor in neutral and instructed all the passengers to move aft to increase the bow freeboard. The operator and passengers moved to the aft section of the boat. A wave then broke over the transom, filling the boat approximately one-half full of water and turned the boat broadside to the wind and waves. The operator started to the helm to put the motor in gear and turn the bow back into the waves. Before he could reach the helm a wave broke over the starboard side completely swamping the boat and causing it to roll to starboard. The boat continued to roll until it was in an upside-down, near level attitude with approximately 1-1/2 ft (0.5 m) of the boat bottom above the waterline. The operator and his son (5) were not sure how they got out of the boat. The other adult male (2) remembers going out over the starboard side. When he surfaced a few feet from the boat he grabbed a cooler nearby that had been washed out of the boat. He immediately noticed that his son (3) was submerged under the port gunwale. He released the cooler, swam back to the boat and pulled his son from under the gunwale.

### 3.3 Post Accident

Passengers (2) and (3) then pulled themselves along the port side a short distance and grabbed the foot of the motor. Upon reaching the motor (2) noticed that the operator (1) and his son (5) were together and a few feet out from the stern on the starboard side. He held to the starboard stern with one hand and pulled them to the boat with the other hand. The four occupants then held to the motor for support. Occupants in the other two boats had witnessed the capsizing and one of the boats (19 ft [5.8 m] runabout) pulled up to the transom of the involved boat within two minutes after the capsizing. All four people were taken aboard the rescue boat. The wife (4)

and daughter (6) of the operator had not been seen since the boat capsized. Passenger (2) decided that he would dive under the boat and see if they had been trapped. The operator of the rescue boat told him that it would be very dangerous to go under the boat in the rough seas and convinced him that the missing pair were not likely to be under the boat, and if they were they had drowned. All the occupants aboard the rescue boat agreed that they had been washed away from the boat and they would try to locate them. The rescue boat circled the involved boat in progressively larger diameter circles for approximately 15 minutes. At this point it was decided to return to the marina and notify Coast Guard rescue. The rescue boat headed toward the marin at a speed of 10 mph (16.1 kph) (maximum safe speed for water conditions). After traveling approximately three miles (4.8 km) a commercial fishing boat was spotted. The rescue boat pulled alongside the commercial boat and notified its operator what had happened. The commercial boat operator then notified the nearest Coast Guard station by marine radio. The Coast Guard station acknowledged the call and reported that a helicopter and rescue vessel would be dispatched immediately. The occupants of the 19 ft (5.8 m) rescue boat decided to return to the marina because the water conditions were getting worse.

Upon arriving at the marina, the local Coast Guard Auxiliary was notified and dispatched a small search and rescue vessel within 30 minutes.

Within one hour after the Coast Guard station was notified of the accident, a Coast Guard helicopter had located the capsized boat. The helicopter searched the accident area until low fuel supply required it to return to base. Before leaving the area, the helicopter dropped a flare to mark the boat location. The Coast Guard Auxiliary boat, and then a Coast Guard rescue boat, located the capsized boat in the vicinity of the flare. The two rescue boats patrolled the area looking for the missing persons for approximately one hour, abandoned the search and returned to the capsized boat. The two rescue vessels were too small to hoist or tow the capsized boat ashore. A large trawler in the area was notified by radio and arrived at the accident site at approximately 1945. Hoisting lines were attached to the capsized boat and the trawler crew started lifting the boat aboard. As the boat came out of the water, the operator's daughter (6) floated out from under the boat wearing an AK-1 PFD. She was immediately taken aboard the trawler where no vital signs could be detected. Efforts to revive her were unsuccessful. The official cause of death was listed as drowning.

As the involved boat was raised further out of the water, the operator's wife (4) could be seen hanging unconscious by her legs from the steering wheel. She was also wearing an AK-1 PFD. As the boat was lifted higher, her legs came out of the steering wheel and she fell in the water. Rescue personnel immediately got her aboard the trawler where a faint heartbeat was detected. Rescue personnel were able to revive her in approximately 15 minutes. She was then taken to the marina by a Coast Guard rescue vessel where an ambulance was waiting to transport her to a local hospital. The involved boat was taken aboard the trawler and transported to the marina.

After the boat capsized, the wife and daughter of the operator (4 and 6) found an air pocket in the bottom of the boat. Passenger (4) could hear the waves slapping against the boat and knew the water conditions outside were rough. She could not swim and decided to remain under the boat until rescued. Her daughter (6) was a good swimmer and tried to convince her mother to let her go outside for help. In order for (6) to swim from under the boat, she would have had to remove her PFD. (4) was afraid (6) would drown without her PFD and decided it would be safer for her to stay under the boat. At first (4) and (6) were relatively comfortable in the air pocket and had no difficulty breathing. After an unknown period of time, the air became stale and the mother became semi-conscious. The last thing she remembered until she regained consciousness on the trawler was her daughter giving her mouth-to-mouth resuscitation to prevent her from losing consciousness. How the legs of the mother got in the steering wheel is unknown; however, apparently her body position was such that her head remained above water after she lost consciousness, preventing her from drowning. It is assumed that (6) lost consciousness at some point and her body position was such that her face became submerged causing her to drown.

Refer to Figure 2 for sketch of accident area.

### 3.4 Time Sequence of Accident Events

0600	Occupants arose, ate breakfast and started preparing for trip.
0645	Party left for marina.
0900	Arrived at marina and launched boat.
0930	Left marina for fishing area.
0950	Arrived at fishing area.
0950-1545	Drift-fished.
1545	Started back to marina at 10 mph (16.1 kph).
1600	Boat capsized.
1602	Occupants 1, 2, 3, and 5 taken aboard rescue boat.
1602-1617	Rescue boat searched for missing occupants.
1635	Coast Guard notified by radio on commercial vessel.
1735	Coast Guard helicopter located capsized boat.
1835	Coast Guard and C.G. Auxiliary boats arrived at accident site.
1835-2000	Search and rescue boats patrolled accident area for missing occupants. Trawler notified.
2000	Trawler arrived and lifted capsized boat aboard.
2000-2015	Attempted to revive Passenger 6. Revived Passenger 4.

#### 4.0 VESSEL DATA

The boat was a tri-hull fiberglass 1973 model Glastron bowrider, powered by a 135 horsepower 1972 Mercury outboard motor. Other than minor gelcoat damage resulting from the accident, the boat appeared to be in excellent condition. The operator and Passenger (2) stated that they observed water squirting out of a hole or crack in the bow section after the boat had capsized. A close visual examination of the bow area revealed no cracks or holes. The operator stated that after the accident the boat was filled with water at the marina where it was purchased. The hull did not leak when filled with water. Additional data obtained during the investigation were as follows:

Model No.:	V186
Length Overall:	17 ft 11 in. (5.5 m)
Max. Beam Gunwale:	7 ft 1 in. (2.2 m)
Max. Transom Width:	6 ft 9-1/2 in. (2.1 m)
Depth Amidships:	27 in. (0.7 m)
Transom Height:	20.5 in. (0.5 m)
Max. Weight Capacity:	1500 lb (680 kg)
Max. Persons Capacity:	1200 lb (544.3 kg)
Max. Horsepower:	150 hp

Refer to Figures 3 - 8 for overall boat views.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator was inexperienced and did not know the limitations of his equipment. He had operated the boat long enough to realize that the boat was not performing properly on the day of the accident, but did not know the reason. He felt confident that his boat was large enough to safely run in the water conditions that existed at the time of the accident. He was not aware of the unsafe characteristics of a bowrider in rough waters. Although he appeared to be in good physical condition, he seemed to be the type individual that had very little confidence in his physical ability. An example is that he never considered going under the boat to look for his wife and daughter because he was not sure he could swim well enough. He had been out in the involved boat in water conditions rougher than the conditions that existed on the day of the accident. This fact probably gave him a false sense of security concerning the limitations of his boat.

Passenger (2) was a more experienced operator and usually accompanied the operator on fishing trips. When the boat freeboard decreased, he suspected water in the inner hull, but did not know what action to take since he had never experienced a flooding before. He seemed to be very confident in his physical ability. He wanted to go under the boat to look for the missing occupants, but was convinced that it would be useless because they were either drowned or were not under the boat.

Passenger (4)'s decision to stay under the boat was most likely influenced somewhat by an article she had read in a magazine a short time before the accident. She had read that a man on an oil rig had survived the sinking of the rig in a storm by finding an air pocket and staying in it until rescued. Other factors discussed in Section 3.3 also influenced her decision.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- Water in the inner hull is considered the major contributing factor. How the water got into the inner hull is unknown. The operator stated that the outer drain plug was installed just prior to launching the boat. Possibly the drain plug was loose or faulty and allowed water to enter the drain hole. The plug had been lost during recovery of the boat and could not be examined. According to the operator, he had never found water in the inner hull and the inner hull plugs were in at the time of the accident. Occupants (1) and (2) stated that they observed water squirting from the bottom bow section after the boat capsized. It is possible that the hull was cracked in such a manner that the crack would only be visible when the hull was under stress.
- Inexperience and overconfidence in his boat on the part of the operator are considered as contributing factors.
- It is the opinion of the investigators that the water conditions that existed at the time of the accident exceeded the safe operating limits of a bowrider of this size.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

According to the estimated weight in the boat at the time of the accident, the boat was not overloaded. The operator and Passenger (2) were certain that the boat was riding lower in the water than usual; therefore, it is assumed that the inner hull contained a significant amount of water. When the bow rode up over a wave, the water in the inner hull would flow to the stern. The weight of the water would decrease the transom freeboard. When the boat rode over the wave crest and the bow went down, the water would flow to the bow, reducing the bow freeboard.

The flotation material was installed in the bottom of the boat which would cause the boat to have a natural tendency to roll when flooded. The waves hitting the flooded boat broadside initiated the roll action that caused the boat to capsize. The boat assumed a stable upside-down attitude due to the location of the flotation material.

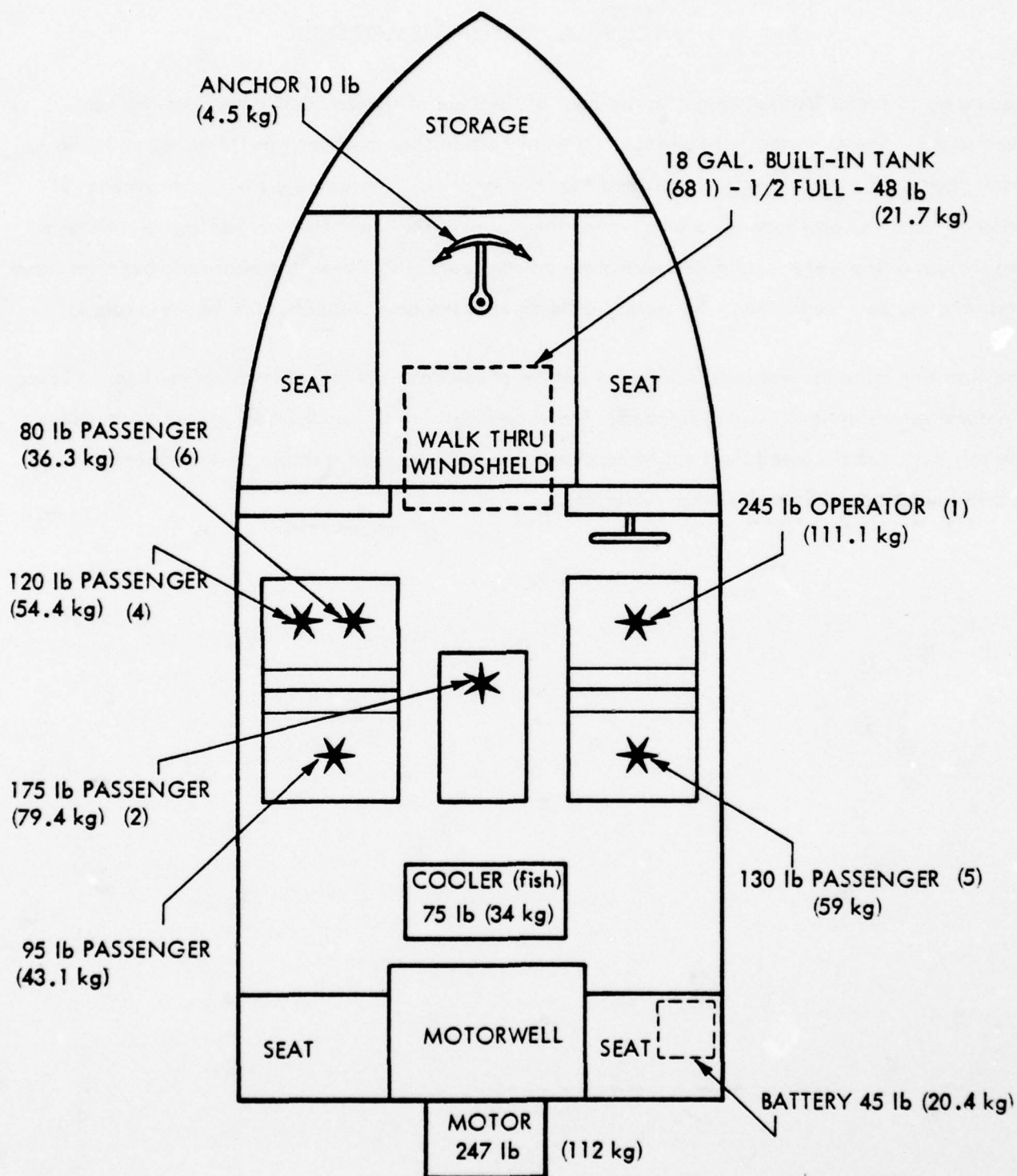


FIGURE 1. BOAT LOAD DISTRIBUTION AT TIME OF ACCIDENT

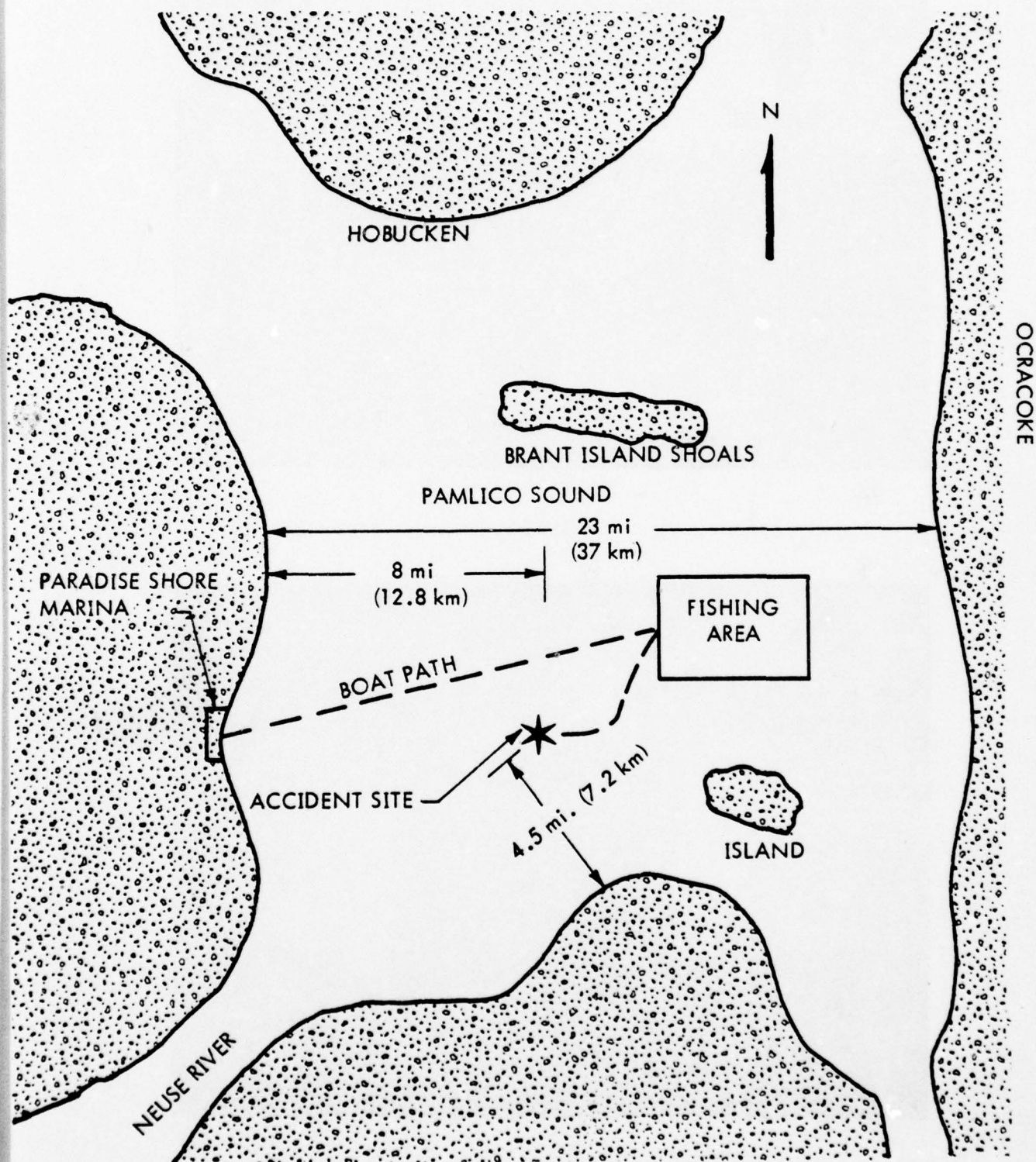


FIGURE 2. SKETCH OF ACCIDENT AREA

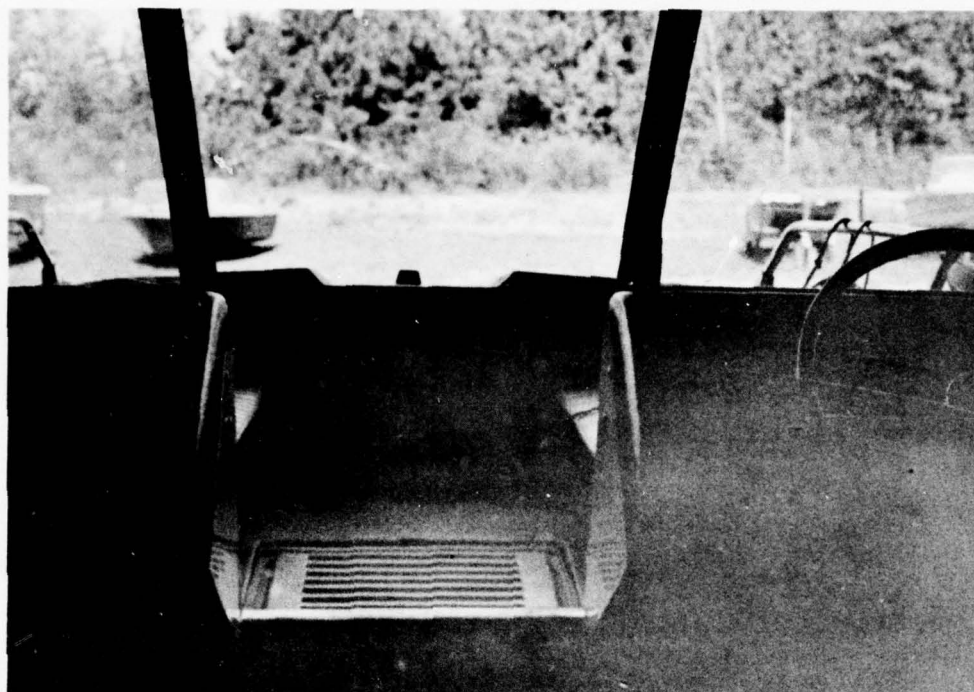


FIGURE 3.

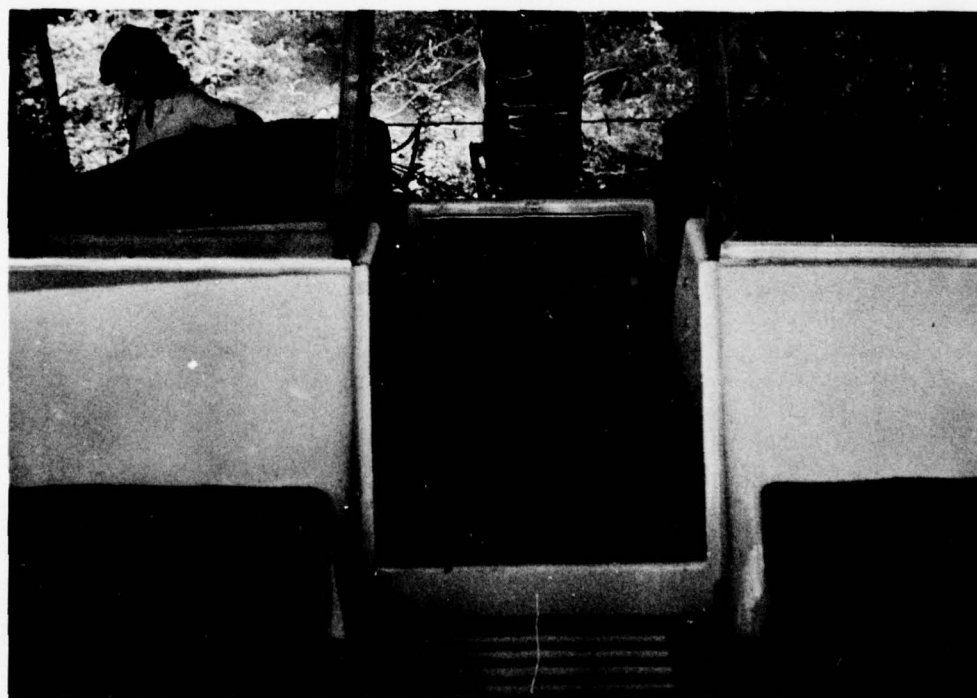


FIGURE 4.

K-16

176



FIGURE 5.

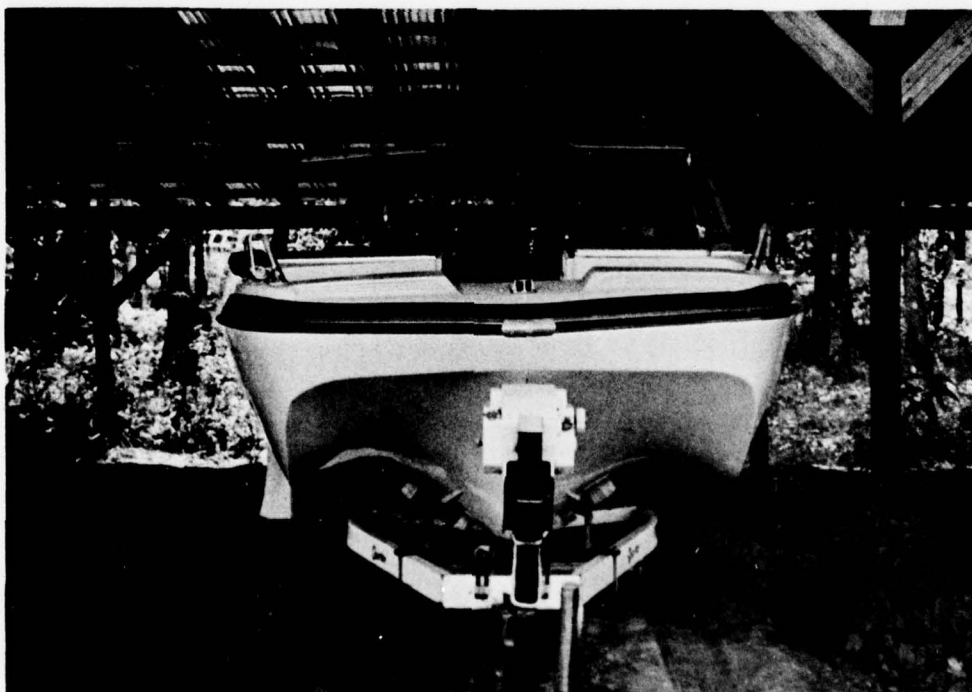


FIGURE 6.

K-17



FIGURE 7.

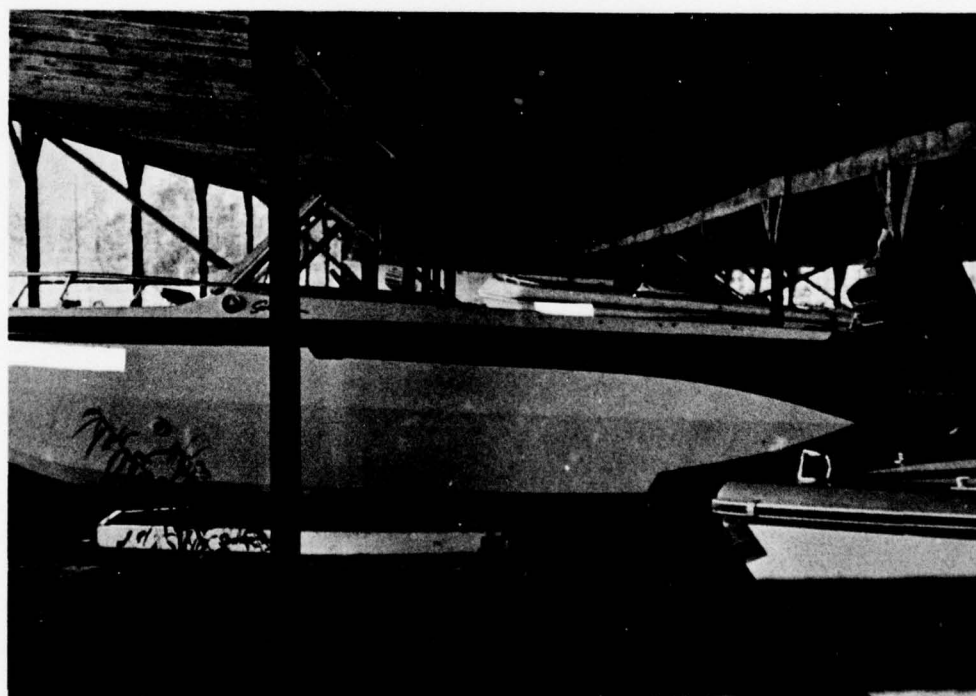


FIGURE 8.

K-18

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: September 30, 1976

Date of Accident: July 8, 1976

Investigation: Capsizing/Swamping No. 76-12

### SUMMARY — WYLE ACCIDENT NO. 76-340

At approximately 1700 on July 8, 1976, two men and two women left for a fishing trip on Lake Erie. Their boat was kept in a marina in a protected area. They boarded the boat and left for the lake towards a fishing area where they heard that the fish were biting. When they arrived at the location, they anchored the boat from the port stern cleat and ate dinner, which they had brought with them. After finishing dinner, they pulled in the anchor and began drift fishing. Shortly after beginning to fish, one of the occupants noticed that there was water in the boat over the cockpit sole. She brought this to the attention of the others, and the operator tried to start the motor to get underway. The engine started but stalled when it was put into gear and would not start again. The occupants began to bail the water out, but by this time the two to three ft (0.6 - 0.9 m) waves were breaking over the transom faster than they could bail the water out. The boat slowly sank below the surface of the water at the aft end and then rolled over as the occupants swam out of the boat. Three of the occupants held onto the boat near the bow and the other was swimming in the area. Several boats passed nearby but apparently did not see the overturned boat. The occupant who was not holding onto the boat decided to swim to shore for help. She swam for about an hour before reaching shore. People on shore saw her and called the rescue squad. The rescue squad signalled a

passing boat which then picked up the rescue squad and went to the overturned boat. The remaining three occupants were taken off the overturned boat and placed in the rescue boat. While on the way to the marina where there were ambulances waiting, one of the occupants died from choking. The other three were taken to the hospital where one was admitted and the other two examined and released. All occupants were wearing AK-1 type PFDs.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Age</u>	<u>Sex</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn/Used</u>	
							<u>Before</u>	<u>After</u>
Owner/ Operator	64	M	183 lb (83 kg)	Fair	<100 hr	None	No	Yes
Passenger 1	60	F	135 lb (61 kg)	Good	Pass. only	None	No	Yes
Passenger 2	36	F	133 lb (60 kg)	Good	Little	None	No	Yes
Passenger 3	38	M	205 lb (93 kg)	Good	<20 hr	None	No	Yes

The owner purchased his present boat in January, 1976, and first put it in the water in May. Prior to this he owned a 16 ft (4.9 m) Lonestar with a 65 hp motor. He had owned this boat for approximately two years before trading it in on his present boat. The first boat he owned was a wooden 14 ft (4.3 m) flatbottom boat which he owned for about three years prior to purchasing the 16 ft (4.9 m) Lonestar. The owner/operator had been retired for about a year. He had worked as a banker, being vice president of a local bank branch. He never had any formal boating instruction but had read a safety booklet given to him by the Coast Guard. He said that the booklet was very helpful, since it contained many items regarding the operation of a boat of which he was not aware.

Passenger 1 was the operator's wife, who had no experience operating a boat but had accompanied the operator most of the time as a passenger. Passenger 2 was the operator's daughter and Passenger 3 was his son-in-law, both of whom had very little boating experience.

## 2.0 ENVIRONMENT

Visibility was good and wind was about 18 knots at the time of the accident. The wife of the operator had called the Coast Guard prior to the outing to obtain the weather forecast. The Coast Guard informed her that there were no small craft warnings in effect, and they had not anticipated any for the remainder of the day. Wave height in the area of the accident was two to three ft (0.6-0.9 m) swells. The occupants said there were no white caps on the lake. Air temperature was in the 70's (21°C), and the water was comfortable and not cold when the occupants were in it.

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

The following narrative was formulated from an interview with the owner/operator and his daughter who was a passenger at the time of the accident.

#### 3.1 Pre-Accident

The operator had planned the fishing trip which resulted in this accident several days before the accident occurred. His daughter had never been out in this boat, and her husband was getting off from work early that day, so they all planned to meet at the marina where the boat was kept. As mentioned in Section 2.0, the wife of the operator had checked the weather and there were no craft warnings posted. The drive to the marina was within sight of Lake Erie, and the operator visually checked the lake to see if there were any white caps present. He said he would never go out onto the lake if white caps were present.

They all met at the marina at approximately 1700 and loaded a cooler full of food on board. The cooler contained dinner which they planned to eat before fishing. They left their docking slip and proceeded to the fueling dock. As they pulled up to the dock, the steering cable on one side of the engine snapped. It was pulley and cable steering, and one of the springs that fastened to the engine had fractured. There was a mechanic from the marina at the fueling dock, and he repaired the steering system in about 30 minutes. The six gal. (22.7 l) outboard fuel tank was filled and a spare 2.5 gal. (9.5 l) can was also filled. Loading of the boat at this time, which is the same as it was at the time of the accident, is shown in Figure 1. There was some question as to the location of the battery. The owner/operator said it was on the starboard side; his son, who was not on board at the time of the accident, said it was on the port side, with the two fuel tanks.

They left the fueling dock at approximately 1750 and went into Lake Erie towards the Ford plant, where they had heard that the fishing was pretty good (see Figure 2). They proceeded directly to that area, arriving approximately 15 min. after they left the dock. The boat was then anchored from the port stern cleat approximately  $3/4$  mi. (1.2 km) off shore. The occupants then ate dinner which they had brought with them, which took about 30 min. After finishing dinner, the anchor was pulled in and they began drift fishing.

### 3.2 Accident

They had been drift fishing for approximately 15 min. when Passenger 2 noticed that there was water in the boat; it was almost to the top of her feet before she noticed it and brought it to the attention of the others. The operator immediately started the engine, but when he put it in gear it stalled and would not start again. All the occupants then donned AK-1 type PFDs. By this time each wave broke over the transom into the boat. Passengers 1 and 2 began to bail the water out with a minnow bucket and the cooler. Passenger 3 moved onto the bow of the boat, attempting to raise the stern further above the water. This did not work, and the waves continued to break over the transom into the boat. The two occupants that were bailing continued to bail until the water was almost to their waists. The three occupants that were still in the passenger area simultaneously jumped over the starboard side of the boat. The operator grabbed a red signalling flag on his way out. The occupants were in the water for about 30 seconds when the boat slowly rolled to starboard and took a bow high, inverted attitude. Passenger 3, who was on the forward deck, was thrown into the water when the boat rolled over.

### 3.3 Post Accident

There was approximately two ft (0.6 m) of the bow sticking out of the water. Passenger 3, who had been on the bow, moved aft and attempted to hold the aft end of the boat down so the bow would stay out of the water. He sat/stood straddling the centerline of the boat just aft of amidships. The operator and Passenger 1 were holding onto the boat on opposite sides up near the bow. The operator had a red flag with him, which he and Passenger 3 alternately waved to try to attract attention. Several boats passed nearby but did not notice the overturned boat. After about 20 min., Passenger 2 decided to swim to shore (about 1930) to get help. She had on an AK-1 type PFD and said that it was easier to swim on her back because if she was on her stomach, waves would hit the part of the PFD that was behind her neck and push her face into the water. While she was swimming, she said a small runabout, apparently going at full speed, came very near her and almost ran her over without seeing her at all. While Passenger 2 was swimming to shore, the other three occupants remained with the boat. The boat was turned broadside to the waves with Passenger 1 being on the windward side. The

operator and Passenger 3 helped Passenger 1 stay with the boat. They said they were not able to move Passenger 1 around to the leeward side of the boat because of the wave motion. The operator was washed from the boat three times but got back to it each time.

Passenger 2 said it took her more than an hour to swim to shore. As she neared shore, she saw some people on the top of the bank that rose from the shoreline. She yelled to them to call the Coast Guard, but they called the rescue squad instead. Passenger 2 said that the people who called the rescue squad said the rescue squad had to pinpoint the location before the Coast Guard could be called.

As Passenger 2 reached the shore, one of the people at the top of the bank came down and helped her out of the water. The rescue squad arrived shortly after Passenger 2 reached the top of the bank. The rescue squad shot several flares to attract the attention of passing boats. The second boat that came by saw the flares and responded by coming to shore. This boat was about 16 ft (4.9 m) long and when told what was happening immediately headed toward the overturned boat. When the rescue boat reached the accident boat, all three accident victims boarded the rescue boat. When they got on board the rescue boat, Passenger 1 complained of a pain in her back. On the way toward shore, she vomited and apparently gasped trapping food particles in her windpipe. One of the occupants of the rescue boat gave her a sharp rap on the back, attempting to dislodge the particle, but to no avail. Passenger 1 choked to death on board the rescue boat heading toward the marina from which they had left. Passenger 2, who had swum to shore, was taken to the marina where the other occupants were being taken by the rescue boat. They were all taken to the hospital where the operator was admitted; the other two were examined, treated, and released. Passenger 3 had most of the skin on his stomach and chest scraped due to the action of the bottom of the boat against him. A local salvage company recovered the boat and towed it to the marina.

### 3.4 Time Sequence of Accident Events

1700	All four occupants met at the marina where the boat was kept.
1705	Gear was loaded on board and the boat proceeded to the fueling dock.
1706	The steering system broke as the boat reached the fuel dock.
1707-1730	The boat was fueled and a mechanic repaired the steering system.
1731	They got underway toward the fishing area.
1745	Boat arrived at the fishing location and was anchored.
1745-1815	All occupants ate dinner that they brought.
1816	The anchor was pulled in and they began to drift fish.
1830	Passenger 2 noticed water in the boat.
1830	Operator started motor, but it stalled.
1831	All occupants donned AK-1 type PFDs.
1832	Passenger 1 and Passenger 2 began to bail water from the boat; Passenger 3 moved to the bow.
1833-1845	Bailing operation continued.
1846	Three occupants jumped out of boat on starboard side.
1846-1/2	Boat slowly rolled to starboard, throwing passenger that was on bow into water.
1847	Three occupants grabbed onto the boat; the fourth occupant swam about in the area.
1848-1905	Operator and Passenger 3 tried to signal passing boats with a red signalling flag.
1906	Passenger 2 decided to swim for shore.
1906-2010	Passenger 2 swam to shore.

2015	Rescue squad arrived at shore .
2020	Passing boat was signalled .
2022	Passing boat headed toward overturned boat .
2025	Rescue boat arrived and transferred people onto the rescue boat .
2027	Passenger 1 choked and died .
2040	Rescue boat arrived at marina and occupants were taken to the hospital .

#### 4.0 VESSEL DATA

Manufacturer:	Penn-Yan	Model Year: 1966
Length Overall:	17 ft 2 in. (5.2 m)	
Max. Beam Gunwale:	7 ft (2.1 m)	
Max. Transom Width:	73-1/2 in. (1.9 m)	
Beam at Chine:	66 in. (1.7 m)	
Depth Cockpit Sole to Gunwale:	29 in. (0.7 m)	
Transom Height:	21 in. (0.5 m)	
Max. Weight Capacity:	1730 lb (784.7 kg)	
Max. Persons Capacity:	1200 lb (544.3 kg)	
Max. HP Capacity:	100	
Hull Type:	Semi-V	
Hull Material:	Molded Fiberglass	
HP On Board:	80 hp 1966 model Johnson outboard	

NOTE: Capacity values were obtained from an outboard motor club capacity plate affixed to the boat.

Figures 3-6 show various views of the boat. Note the control cable cutouts in Figure 5. These will be discussed further in Section 6.0.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

There are several interesting occurrences that should be discussed regarding this accident. The operator of the boat felt that the boat sank slowly enough at first that if they had had a flare gun, they could have easily signalled a passing boat before the boat turned over. The owner/operator of the boat and his daughter were both told when they bought it that the boat would not sink. They also were told that in the case of an accident they should stay with the boat. Even though they knew this, the daughter of the operator swam for shore. The operator said he too would have swum for shore if he did not have to hold his wife on the overturned boat. The operator's daughter felt that they all would have drowned had they all stayed with the boat. Before she began swimming to shore, she said that several boats passed within sight of the overturned boat. She said one large cruiser was so close that she could clearly see the people on it. Apparently the hand held signalling flag did not attract their attention. The bottom of the overturned boat was painted blue, which did not contrast at all with the water. Perhaps if the bottom of the overturned boat had been a color that contrasted with the water they would have been spotted. If no boats had passed by the overturned boat, all occupants may have stayed with the boat longer, awaiting help. The despair of seeing a potential rescue boat pass by was probably a contributing factor in the decision to swim to shore for help. In this case going for help may have been the best course of action. As it was, the three occupants that remained with the boat had to cling to it for nearly two hours and were near total exhaustion when they were rescued.

The occupant that swam for shore had difficulty swimming with the PFD on due to its design. It was an AK-1 type, and the wearer said that it was fastened properly but possibly slightly out of adjustment for her. (She also mentioned that a snap type fastening below the chin instead of the tie type would have greatly increased the speed and ease with which they could have been donned during the swamping.) The front section of the PFD hindered her arm movement as she tried to swim on her stomach; in addition, when a wave would reach her, it would hit the part of the PFD that was behind her head and force her face below the surface of the water. She found it much more comfortable and efficient to swim on her back. She was swimming on her back when she heard the speeding runabout approach, and by the time she

turned to face it, it had gone past her, very close by. Perhaps if she had seen it approaching she could have waved her arms in the air or splashed frantically to attract attention.

The operator stated that the boat always heeled to starboard while underway, regardless of the load condition (even with all the occupants on the opposite side, the boat would always heel to starboard). This was apparently a dynamic effect only, because when the boat was not underway, it did not heel in that manner.

One common design feature of this type boat should also be mentioned. The boat had a decked bow with a windshield that went completely across the front of the boat and partially along the side. In order to reach the forward cleat, one would have to climb over the windshield. It was much easier to tie the anchor to the port stern cleat which was very accessible. Tying the anchor line to the aft cleat appears to have initiated this accident. The location of the control cable cutouts at the same level as the transom allowed water coming over the transom to enter the passenger carrying area.

#### 6.0 PROBABLE CAUSE OF ACCIDENT

It appears that anchoring the boat by the stern in a seaway initiated this accident. Poor location of control cable cutouts was a major contributing factor. As can be seen in Figures 5 and 6, the cutouts are at approximately the same vertical level as the transom, and they had no rubber boots on them to restrict the inflow of water. There were three cutouts present, two on the starboard side and one on the port side. The offcenter loading at the aft end of the boat may also have contributed to lowering the transom enough to allow water to enter. There was no bilge pump in the boat. An automatic bilge pump located aft would have begun to work before the water level reached as high as it did, and preventive action could have been taken sooner.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The boat was anchored by the port stern cleat. As can be seen in the loading diagram (Figure 1), the aft port side of the boat had a rather large concentration of weight. This would cause the boat to heel to port and trim aft. The operator's daughter said that there was a little water in the boat when they left the dock. With the boat trimmed aft and heeled to port, this water would also add to the heel/trim by flowing into that corner. This excess trim and heel alone might have been enough to reduce the freeboard at the port aft corner enough to allow water to flow over the transom into the motor well. The boat being anchored by the aft port cleat in two to three ft (0.6 - 0.9 m) waves would almost certainly allow water, as each wave hit the transom, to flow into the motor well. The location of the three control cable cutouts was such that the lower edge of each cutout was at the same vertical height as the transom. The absence of rubber boots on the cutouts permitted water coming over the transom to easily pass through the cutouts into the interior of the boat. The double bottom, which apparently had no flotation material and possibly could have leaked through the water sump at the transom, could have partially filled with water before the level reached the cockpit sole. Even if it did not fill with water, the attitude of the boat permitted an accumulation of a large amount of water before the passenger in the starboard aft seat noticed the water almost over her feet. If the boat were heeled to port as indicated by the weight distribution, then the water level at the port side would have been even greater. The accident may have been avoided if the engine would have run and allowed the boat to be headed into the waves. As it was though, the engine would not run, and bailing operations could not keep up with the inflow of water. By this time freeboard aft was reduced sufficiently to allow each wave to break over the transom and into the interior of the boat. The heeling moment caused by all the occupants exiting from the same side of the boat initiated a rolling motion which was amplified by the free surface effect of the water in the boat, causing the boat to capsize and come to rest in an inverted, bow high attitude.

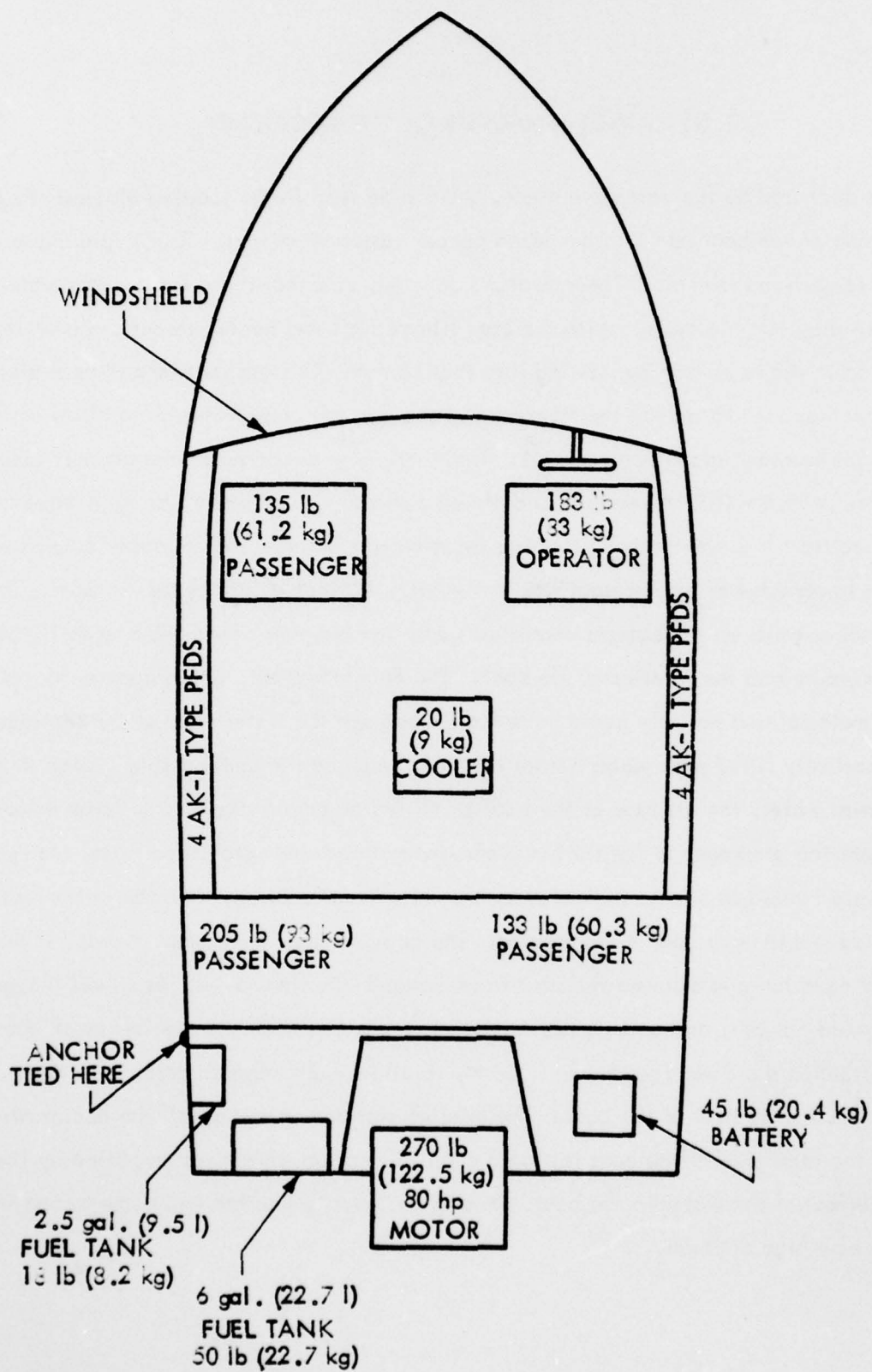


FIGURE 1. LOADING DISTRIBUTION AT TIME OF ACCIDENT

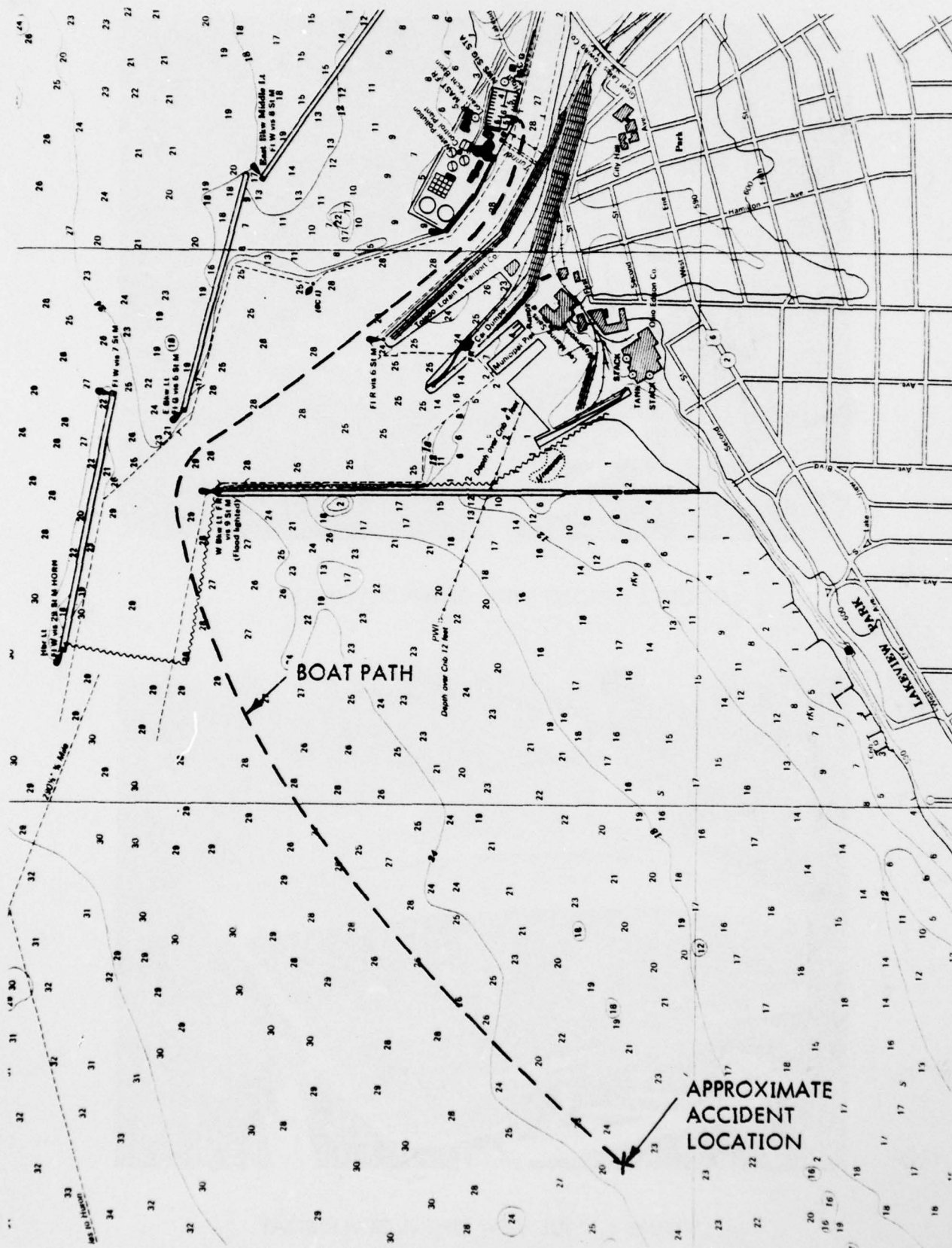


FIGURE 2. ACCIDENT AREA  
L-13



FIGURE 3. FRONT VIEW OF INVOLVED BOAT



FIGURE 4. SIDE VIEW OF INVOLVED BOAT

L-14

192

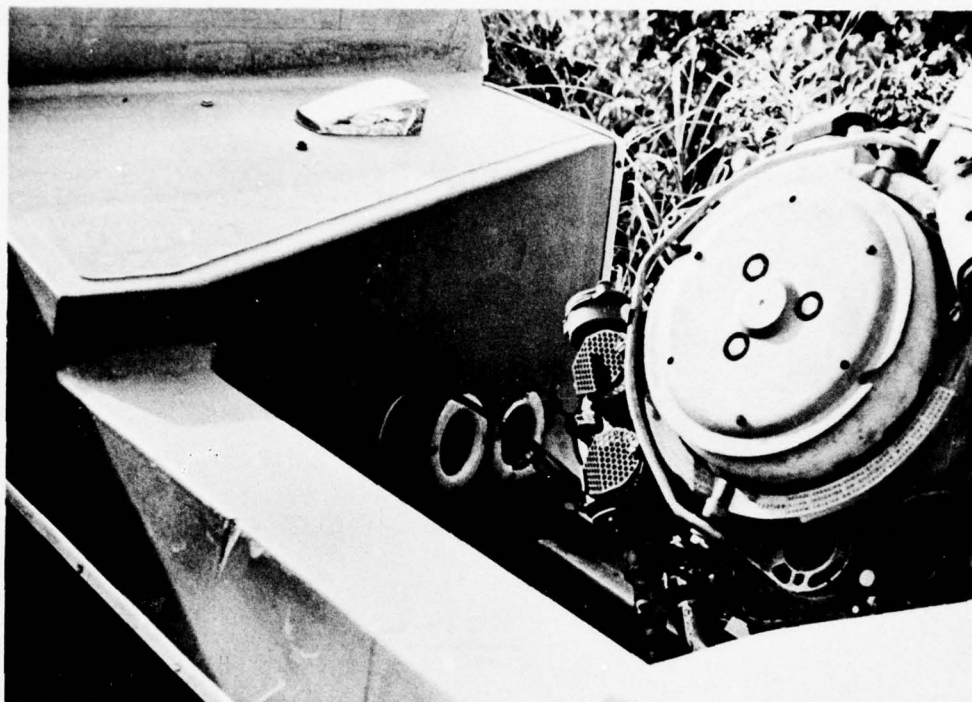


FIGURE 5. VIEW OF CONTROL CABLE CUTOUTS

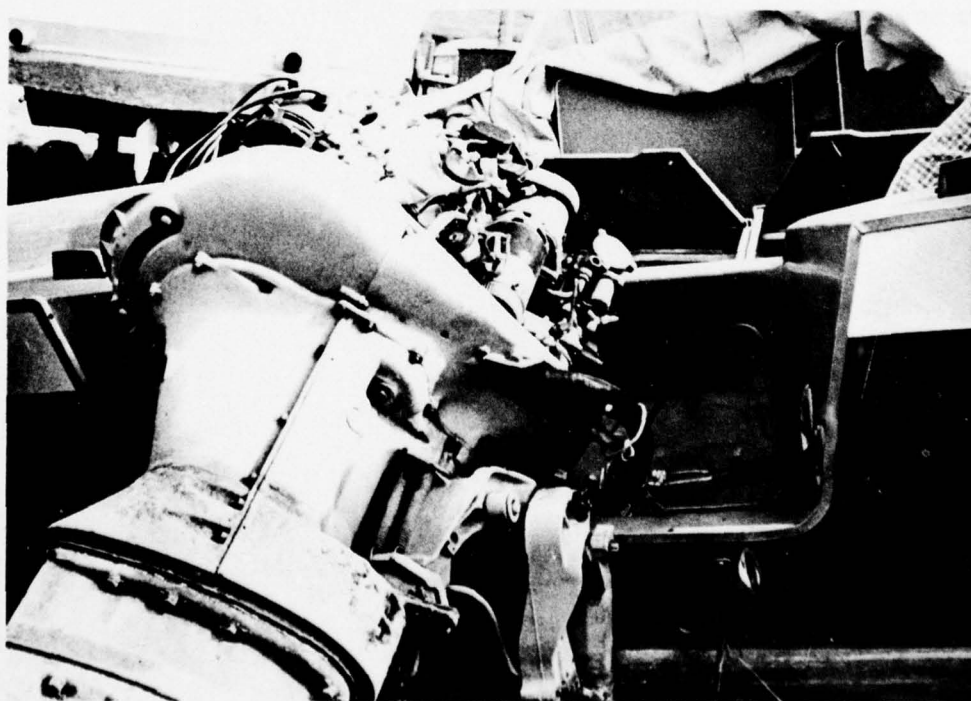


FIGURE 6. STERN VIEW OF INVOLVED BOAT

L-15/16

193  
194X

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: September 30, 1976

Date of Accident: August 19, 1976

Investigation: Capsizing/Swamping No. 76-13

### SUMMARY — WYLE ACCIDENT NO. 76-464

On the afternoon of August 19, 1976, the owner/operator of the boat, his father-in-law, and a 14 year old neighbor left for a fishing outing with a 15 ft (4.6 m) bowrider powered by a 55 hp Chrysler engine. They launched the boat in the Chagrin River inland from Lake Erie. They proceeded into the lake and a short distance southward to a protected cove where they began to fish. They fished for a couple of hours, and then decided to return to the launch area. When they left the cove and proceeded into the main body of the lake, they encountered waves that were much larger than when they had first gone out. Successive waves broke over the bow, filling the boat with water, causing it to capsize. A boat that was nearby came to their aid within a minute. The operator and the 14 year old boy were rescued. While they were climbing aboard the rescue boat, the body of the operator's father-in-law, who had sunk out of sight immediately after the capsizing, surfaced. It was taken on board the rescue boat. The 14 year old boy was the only occupant who was wearing a PFD.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn/Used</u>	
							<u>Before</u>	<u>After</u>
Owner/ Operator	M	57	195 lb (88 kg)	Good	>500 hrs	None	No	No
Passenger 1	M	14	180 lb (81 kg)	Good	Passen. only	None	Yes	Yes
Passenger 2	M	76	210 lb (95 kg)	None	Passen. only	None	No	No

The owner/operator, who worked at a dry cleaning company, had purchased his present boat new in 1972. Prior to this boat he had owned one other boat. It was a decked runabout which he had for two or three years before purchasing his present boat. He had no formal boating instructions, but had read boating literature on safety.

His father-in-law and his 14 year old neighbor had only been boating as passengers and had no experience in operating a boat.

## 2.0 ENVIRONMENT

At the place of launch, which was inland on a river, the water was calm. When the lake was first entered, wave height was about one ft (0.3 m). The protected cove where the fishing was done was also calm. While they were fishing, the seas built on the lake to three to four ft (0.9 - 1.2 m) in height. Wind was moderate at 7-14 mph (11.3 - 22.5 kph). Air temperature was 68°F (20°C) and water temperature was 74°F (23°C).

### 3.0 NARRATIVE DESCRIPTION OF THE ACCIDENT

The following narrative was formulated from an interview with the owner/operator of the involved boat.

#### 3.1 Pre-Accident

The owner/operator of the boat left work early on the day of the accident. He called his father-in-law and asked if he wanted to go fishing. He agreed, so they planned on meeting at the operator's house. The boat was kept in a garage on a trailer across the street from the owner's house. The third occupant was a 14 year old neighbor of the owner. They hooked the boat up to the car and trailered it to the launch area, which was on the Chagrin River approximately 20 mi (32.2 km) away. The loading arrangement at time of launch, which was the same as at the time of the accident, was as shown in Figure 1. After launching the boat, they proceeded down river to Lake Erie (Figure 2). They went into the lake and headed southwest to a small cove where they had planned to fish. The cove was about 200 yd (182.9 m) from the mouth of the river. The trip from the launch area to the fishing cove took approximately 20 min. While they were fishing at the cove, the 14 year old boy wanted to get off the boat and fish from the bank. The operator told him to put on an AK-1 type PFD before he left the boat, which he did. After fishing for approximately two hours, they decided to return to the launch area. The operator picked up the boy from the bank and then proceeded out of the cove toward the Chagrin River.

#### 3.2 Accident

As soon as they left the cove, they encountered waves much larger than when they first came out. Within a minute one wave broke over the bow, filling the boat with a large amount of water. The operator instructed the 14 year old to start bailing and said he was not terribly concerned at this time. They were proceeding at slightly faster than idle speed. The operator said that the next wave looked 15 ft (4.6 m) high, but he said that it probably really wasn't. This wave and the next wave or two (he doesn't remember how many) broke over the bow into the boat, filling it with water and causing it to capsize. The operator said that after he saw the 15 ft (4.6 m) high wave, everything happened so fast that he could not remember any details. The 14 year old

had been quite disturbed by the whole incident, and the operator did not want him to participate in the interview.

### 3.3 Post Accident

The boat was floating inverted and approximately level with the operator and the 14 year old swimming nearby. The operator's father-in-law was not in sight. Within a minute a nearby boat was alongside the capsized boat, and the operator and 14 year old climbed aboard. As soon as they were aboard, they looked back toward the overturned boat and saw the operator's father-in-law surface with his back up and face down in the water. They picked him up and brought him aboard the rescue boat, and as best they could tell, he was dead. The rescue boat took them to a marina near the mouth of the Chagrin River. The father-in-law and 14 year old were taken to the hospital and the operator notified the Coast Guard and was questioned by local authorities before he was taken to the hospital an hour later. The operator and the 14 year old were examined and released. The father-in-law was pronounced D.O.A. A local salvage company towed the boat six miles (9.7 m) to a marina for a fee of \$ 250.

### 3.4 Time Sequence of Accident Events

1430	Operator called his father-in-law and invited him to go fishing.
1500	They left the operator's house and proceeded to the launch area.
1540	They arrived at the launch site and launched the boat.
1545-1605	They proceeded to the fishing area which was in a protected cove.
1850	They left the cove and headed into the lake toward the mouth of the Chagrin River.
1852	A large wave broke over the bow.
1853-1854	Several additional waves broke into the boat, flooding it.
1855	Boat capsized.
1900	Nearby boat picked up the occupants.

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WYLE LABS HUNTSVILLE ALA  
CAPSIZING/SWAMPING ACCIDENT INVESTIGATIONS FOR 1976 SEASON. (U)  
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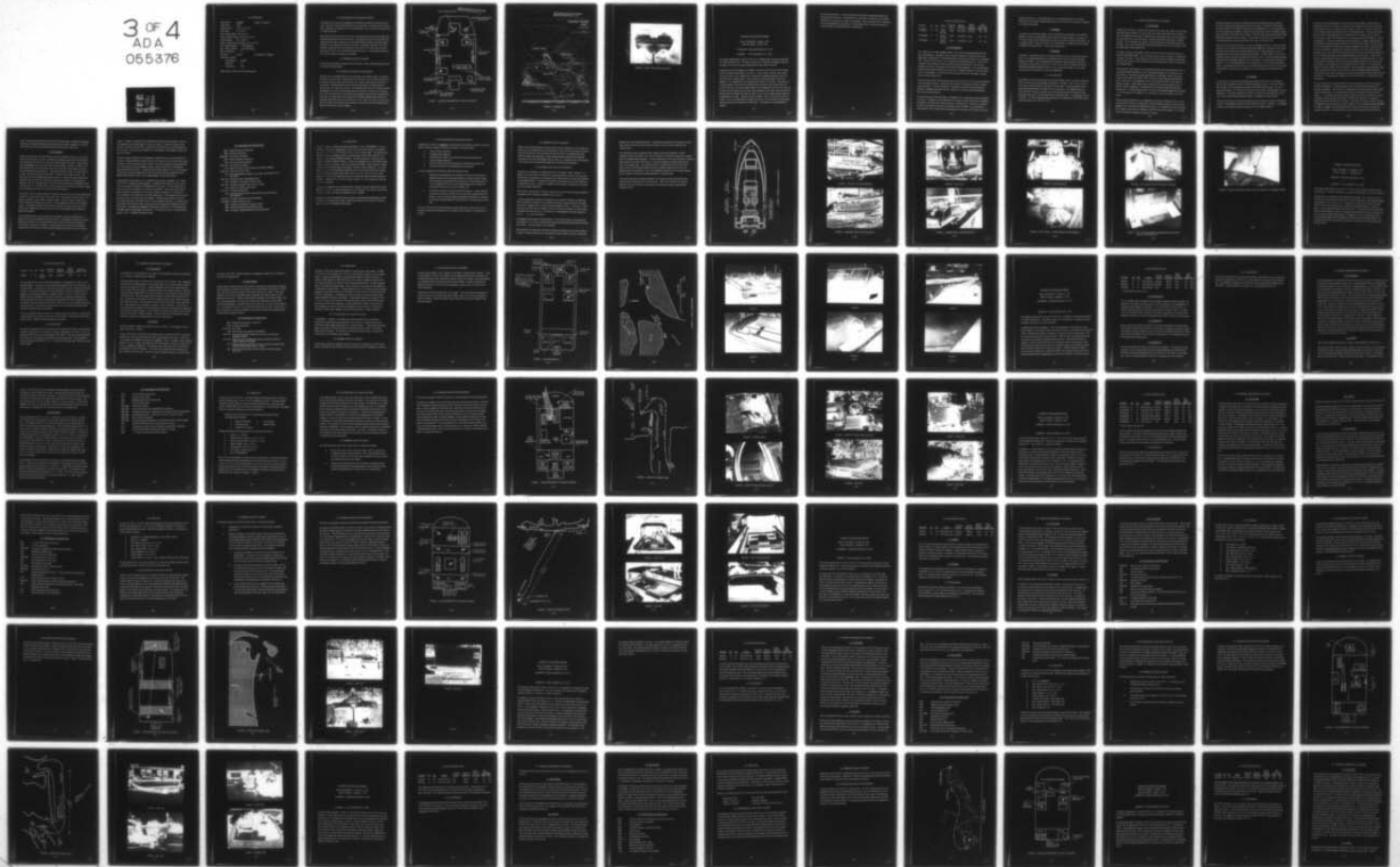
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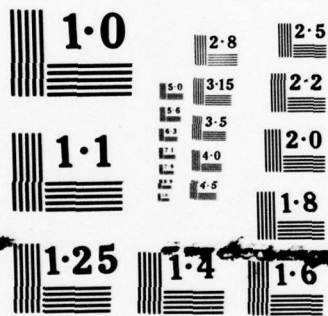
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NATIONAL BUREAU OF STANDARDS  
MICROCOPY RESOLUTION TEST CHART

#### 4.0 VESSEL DATA

Manufacturer: Fabuglas                      Model: 154 Mark II  
Model Year: 1972  
Length Overall: 15 ft 5 in. (4.7 m)  
Max. Beam: 77 in. (2 m)  
Max. Transom Width: 73 in. (1.9 m)  
Transom Width At Chine: 59-1/2 in. (1.5 m)  
Transom Height: 21 in. (0.5 m)  
Depth - Cockpit Sole to Gunwale: 27 in. (0.7 m)  
Max. Weight Capacity: 1775 lb (805 kg)  
Max. Persons Capacity: 6 @ 150 lb (68 kg)  
Max. HP Capacity: 95  
Hull Type: Tri-Hull                      Hull Material: Fiberglass  
Horsepower on Board:  
    Manufacturer: Chrysler  
    Rated HP: 55  
    Model Year: 1967

Figure 3 shows a front view of the involved boat.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator did not require his passengers to wear PFDs even though one of them could not swim. When the 14 year old left the boat to fish from the bank, the operator had him wear a PFD. Apparently, the operator felt it was more dangerous to be on land near water than to be in a boat on the water.

When they left the cove to return to the river, they encountered waves that were larger than they had encountered when they first went out. The operator said that by the time they were rescued and taken back to the dock, the waves had calmed down again, and that this rapid change in wave conditions was common on the lake. The operator stated that if the waves had been as large when they were coming out of the mouth of the river as they were when they came out of the cove, he would have returned to the river. He should have returned to the cove and waited for a change in the weather.

## 6.0 PROBABLE CAUSE OF ACCIDENT

This accident was caused by operating an open bow boat in water conditions that proved to be too severe for the boat design.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The boat was not overloaded based on the values stated on the capacity plate. The operator said there was no free water in the boat prior to the accident. The low profile and open bow of this boat allowed a wave to break over the bow, causing a large quantity of water to run into the boat. Heading directly into the waves could have been a contributing factor in allowing the wave to break over the bow. The increased load of the water in the boat lowered the freeboard of the boat, allowing additional waves to break into the boat with increasing ease. The free surface effect of the water and any passenger movements then caused the boat to capsize. The operator felt that his father-in-law had been trapped under the boat and suffocated after breathing from an air pocket for a while. Since it was only a very short time from the accident until his father-in-law surfaced, he could have had a heart attack or have been hit on the head as the boat capsized.

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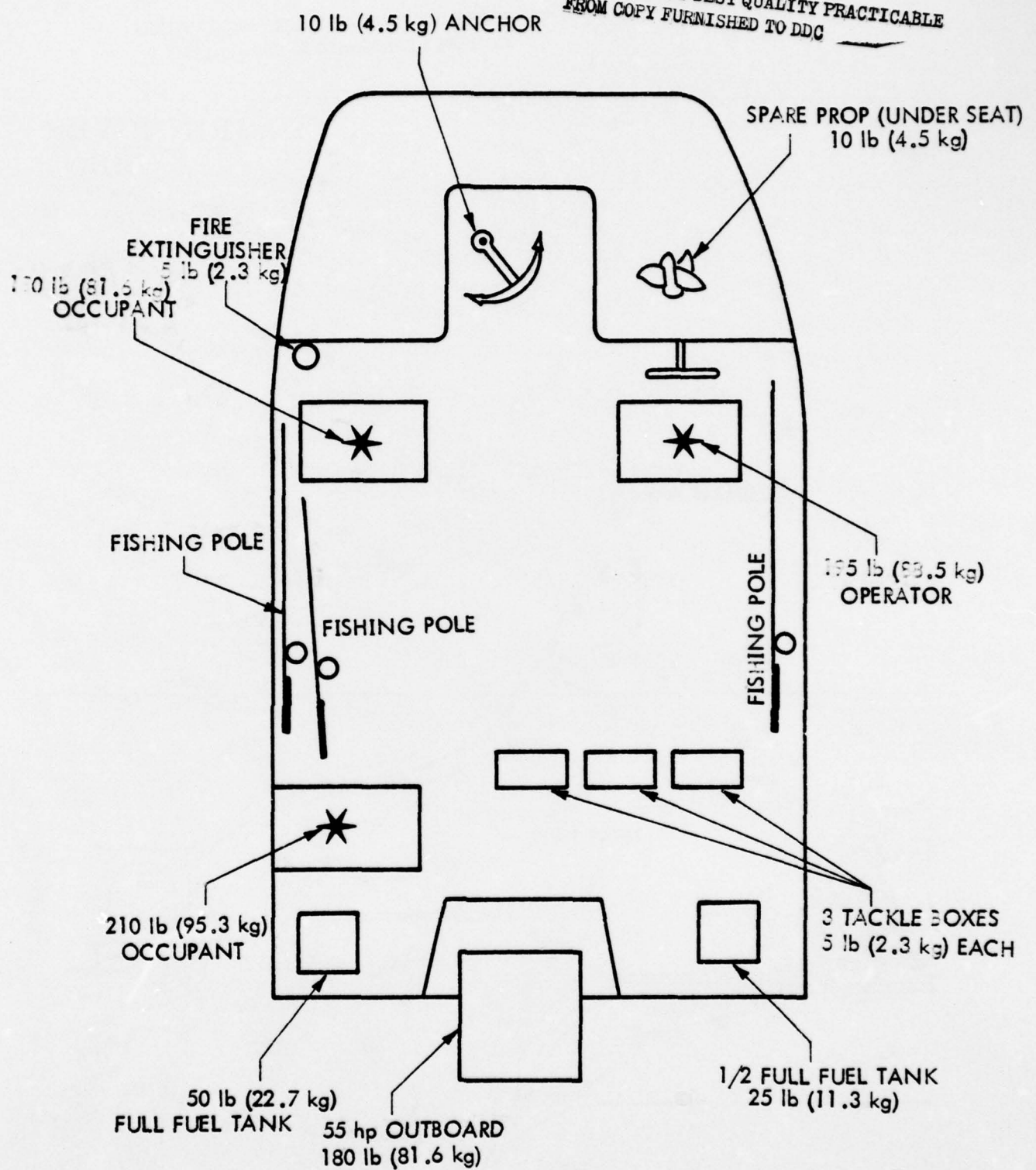


FIGURE 1. LOADING DISTRIBUTION AT TIME OF ACCIDENT

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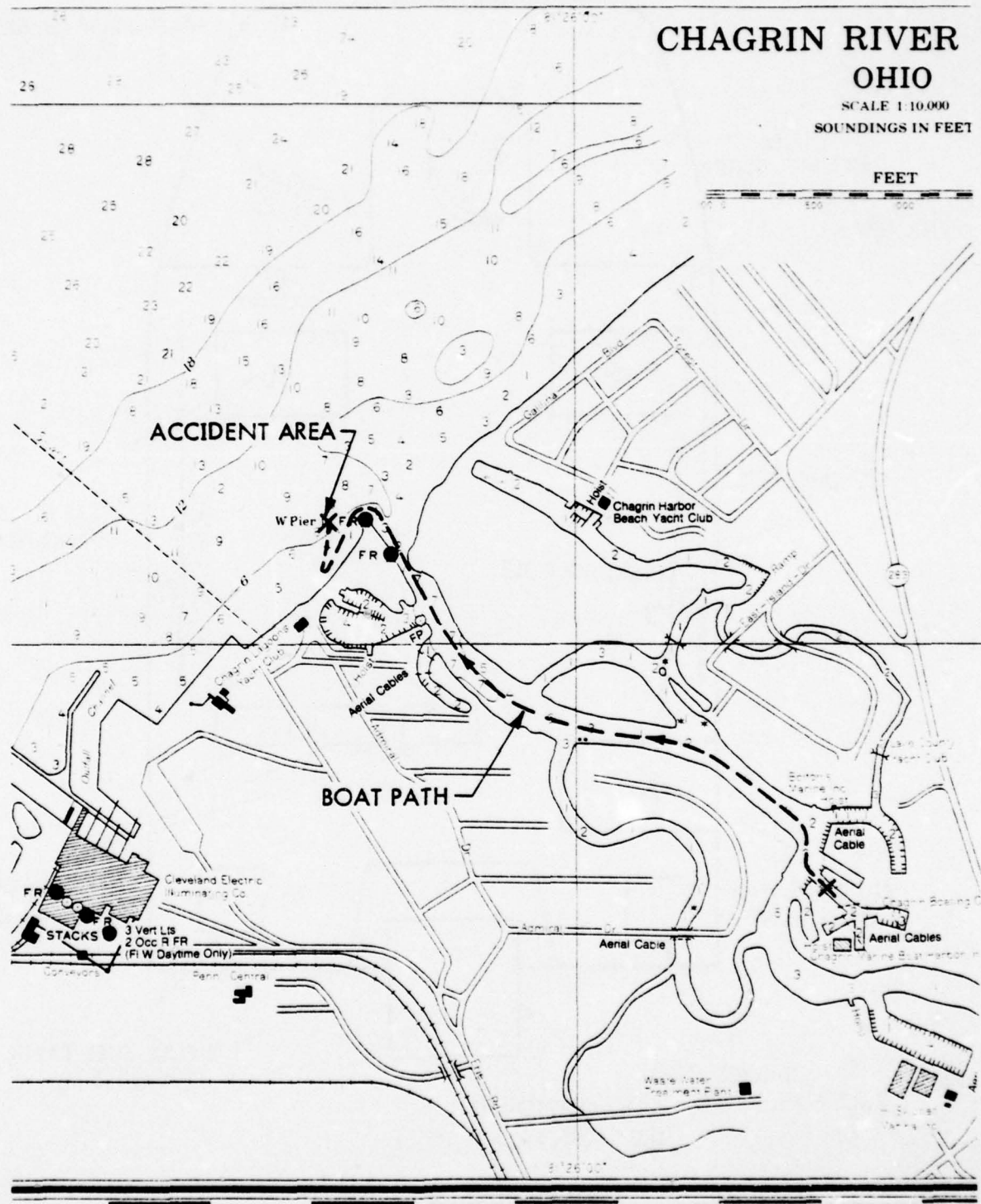


FIGURE 2. ACCIDENT SITE

M-8

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FIGURE 3. FRONT VIEW OF INVOLVED BOAT

M-9/10

203  
204X

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: August 6, 1976

Date of Accident: July 25, 1976

Investigation: Capsizing/Swamping No. 76-14

### SUMMARY — WYLE ACCIDENT NO. 76-411

The accident reported herein involved a 23 ft (7.0 m) fiberglass open fishing boat powered by twin 135 hp outboard motors. The type of accident was a swamping and subsequent capsizing. One person was injured and required hospitalization; there were no fatalities.

A businessman and his teenaged son and nephew set out from a resort town on the New Jersey coast for a Sunday of sport fishing on the ocean. At about 1030 or 1100 they were at least 12 nautical miles (19.3 km) offshore when a large fish of undetermined species struck two of the lines which were being trolled. After awhile some line became fouled in one of the propellers. One, perhaps both, of the engines were shut down at that time. The attention of all three occupants was taken up by the difficulties with the fish while the boat's stern was exposed to the seas, which were probably higher than the reported one to two ft (0.3 to 0.6 m). The boat took on a large quantity of water, both through the control cable cutouts and over the forward motorwell bulkhead, the effective height of which may have been markedly reduced if a hinged section was open. The boat eventually capsized, and as it did the owner's foot was injured. Time was available before the capsizing, however, for the occupants to don personal flotation devices and to attempt quick distress calls, which apparently went unbroadcast or unheard.

The three men remained on the overturned boat with the aid of an improvised lifeline until rescued almost 24 hours later. They had not left a "float plan" and were not yet considered overdue by their families, so no search was conducted. They were rescued when a commercial fishing vessel happened to pass nearby. The injured boat owner was further evacuated by a Coast Guard boat, and required one day's hospitalization.

## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Boating Instruction	PFD Worn/Used	
							Before	After
(1) Operator	M	51	154 lb (69.9 kg)	Good	Over 500 hr	CG Aux.	No	Yes
(2) Passenger	M	19	164 lb (74.4 kg)	Good	Over 500 hr	None	No	Yes
(3) Passenger	M	17	145 lb (65.8 kg)	Good	Over 500 hr	None	No	Yes

### 1.1 Owner/Operator

He is married, has two older teenaged children, and is the shirt-sleeves publisher of several small trade magazines. He appears to be of average intelligence and physical ability, and reports being in good health. He purchased the boat involved in the accident new in September, 1975. Since then he had used it on many weekends during the boating season. Other than an occasional trip waterskiing, the boat was always used for offshore fishing. The two other occupants on the day of the accident are his regular fishing companions. The owner mentioned having received a good introduction to his boat and an underway checkout in it from the marina where it was purchased. He also said that he never wears a PFD while in the boat, although he always carries enough along.

This was the second boat he has owned, the previous one being a 17 ft (5.2 m) outboard runabout which was used for 13 years. The first boat was taken out on the ocean only rarely, and then always near shore. The owner claimed not to have been involved in any previous boating accidents, although during World War II he was adrift in a raft for 24 hours after being shot down over the English Channel.

The owner spoke quite fondly of his boat, and apparently took a great deal of pride and pleasure in owning it. Although it was recovered after the accident, the boat (and motors) will probably be declared a total loss by his insurance company, as discussed later. Inasmuch as a large sum of money would likely be involved in the settlement (over \$10,000) it is not surprising that several details of the accident might be misrepresented or intentionally left unclear as a way of

protecting interests, as it is believed they were. As also explained below, the narrative description of the accident is based almost entirely on an interview with the owner, and should be considered accordingly.

### 1.2 Passenger

This young man is the owner's nephew, and was invited by him to be present at the interview, possibly as a means of controlling the type of information he might provide in the matter. In any case, he kept very quiet during the joint interview, and did not add much information. He is a college student, single, tall and thin, and in good health. He appeared to be of average intelligence and physical ability. He has never owned a boat.

### 1.3 Passenger

This person is the owner's only son, and was said to be out of town at the time of the investigation. He was described as being very interested in boats and an avid reader of boating magazines and books. He had a good amount of experience operating the boat involved in the accident, and had taken it out alone. In fact, he was said by his father to be the more capable and experienced operator of the two. He is a high school student, lives at home, and was said to be athletically inclined and in good health.

## 2.0 ENVIRONMENT

The weather at the time of the accident is one of the variables which is in question in this case. When interviewed, the owner described the weather as "excellent:" one ft to two ft (0.3 to 0.6 m) seas, excellent visibility, clear skies, and light winds. He also mentioned that conditions remained essentially unchanged until they were rescued. During debriefing by the Coast Guard after the rescue, however, one of the younger occupants mentioned that they were preparing to return to port because the seas were getting rough. This discrepancy remains unresolved. The Coast Guard reported the approximate air temperature as 75°F (24°C) and the water temperature as 68 - 70°F (20 - 21°C).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

The boat owner maintains a vacation home along the New Jersey coast where he and his family spend most summer weekends. His usual routine was to drive the 60 miles (96.6 km) from his home in Philadelphia to the shore on Friday evenings, spend all day Saturday and/or Sunday on the ocean fishing with his son and nephew, and return home either Sunday night or Monday morning. On the weekend of the accident, the three had gone out fishing during the day on Saturday. (The owner mentioned never intentionally staying out on the water at night.) They got a good night's sleep Saturday night.

On Sunday, the day of the accident, the three set out from the marina where the boat was moored at about 0830 to 0900. They always go out alone, never in company with another boat. No type of "float plan" is ever used; and on that day the other family members returned home early and did not expect to hear from the three until perhaps Monday morning, the latest they were due back home.

The owner hadn't eaten breakfast, but water and sandwiches were carried aboard the boat. It was reported (somewhat defensively) that no alcoholic beverages were consumed prior to or during the trip. Navigation and safety gear onboard included several charts of the area, a compass, depth finder, six-channel VHF-FM transceiver, three marine type hand-held red flares, a first aid kit, fire extinguisher, and six Type II adult size PFDs, stored inside the operator's console. Notably absent were an anchor and line (one short length of line was stored in the bow compartment), a throwable PFD, and a bucket or other portable bailer. The permanently installed 100 gallon (379 l) fuel tank was filled before departure that morning. Also taken along were 10 five gallon (19 l) cans of gas, an unknown number of which were filled.

The below deck compartment was not inspected for water prior to or during the trip, but the owner recalled that the electric bilge pump, wired for automatic operation, came on for short periods of time while they were underway that morning. It is interesting to note that the owner left all repairs, maintenance, and upkeep of the boat to the marina and dealer. In his words, "The marina handles everything; we just get in it and go."

After getting underway, the owner, reported to be boat's sole operator that day, headed to one of their offshore fishing spots several miles down the coast. He reports having obtained the marine forecast on the weather channel of his VHF radiotelephone, as is his usual practice, and that the forecast was favorable. After fishing awhile without success, he headed to another area, either 28 or 12 NM (45 or 19 km) offshore. (The first figure was given during Coast Guard debriefing; the other during the interview.) At some point on their way the owner and his son were splashed by spray, and so removed their shoes, socks, and trousers to dry.

Upon arrival at the second fishing area, four lines were rigged for trolling. The owner reported that the sea was to his stern as he maintained the same heading taken from shore as they trolled. He said that he normally trolls with both engines running, as a safety precaution. The two passengers stood in the stern and handled the fishing tackle. At about 1030 or 1100 two of the lines were struck by what later was determined to be but one fish. The owner slowed the engines somewhat while his passengers fought the fish, first letting it run and then setting the hook and reeling it in. The owner recovered the two uninvolved lines, so as not to have them become fouled. He reported that the fish was on the line about 20 or 25 minutes prior to the occurrence of the accident, and that during that period it was in close proximity to the boat about four times.

### 3.2 Accident

The owner left the controls for some undetermined length of time to assist in the attempt to boat the fish, and claimed to have first shifted both engines to neutral. While near the stern, and with gaff in hand, he observed the shadowy figure of the large fish about 15 ft (4.6 m) beneath the surface. (At no time was the fish seen out of the water, and the species was never determined.) It then dove, passed under the stern, and came back toward the surface, resulting in some line and leader becoming entangled in the propeller of the port engine.

(The events of the next few minutes are somewhat confused. Especially unclear is the sequence of events, which seemed to change with each retelling of the story. Therefore, it is considered unlikely that the following events occurred exactly in the order mentioned.)

The engine with the fouled propeller was shut off by the owner's nephew. He did not admit stopping the other engine, however. All three men were looking over the side for the fish and trying to decide what to do, what sort of fish it might be, and so on. After a few minutes one of the younger occupants exclaimed that water was covering their feet. The owner said that he looked up and saw water "gushing" over the transom and into the cockpit, but he could not recall for certain whether the hinged section of the transverse motorwell bulkhead was in place or folded down. (It was said to normally be left up and secured.) Someone plugged the drains of the self-bailing cockpit to prevent further entry of water from that source. The large access hatch to the after part of the under deck compartment popped up when there was about one foot of water in the cockpit, revealing the lower area to be nearly full of water. Both the owner and his son went in turn to the controls to head the boat into the sea and avoid continued swamping, but they found both engines to be stopped and unable to be turned over. They moved to the bow to improve the boat's worsening trim, but were unable to significantly affect it. There was some effort at bailing by hand, but the owner described the ingress of water over the stern as quite rapid. Both younger men made hurried distress calls on Channel 16, but neither was thought to include the boat's call sign or position. (Only) the nephew recalls hearing the words "Coast Guard" after his mayday call, and that the radio went dead immediately thereafter. (Following the rescue, Coast Guard search and rescue forces thoroughly reviewed tapes of activity on Channel 16, but discovered no messages from the involved boat or any unidentified distress transmissions.)

The owner directed his son to get some PFDs from their storage locker; and the three men each donned one immediately. The boat had been listing to one side and then the other as the occupants moved about. The owner was in the process of moving forward to the control console to get the distress flares when the boat lurched to one side, and then continued to roll and capsized. He had fallen forward when the boat lurched, and landing on the deck hit his head and broke his watch, the only one on board. He recalls that when he fell, his head was beneath one and one-half feet (0.5 m) of water. As the boat was rolling, he tried to stand up, but happened to step into an open tackle box, resulting in several fishhooks becoming embedded in his foot. He began to pull out the hooks at once, but did not finish until the boat had capsized on top of him. He eventually swam from under the overturned boat and joined the

others, who had successfully exited over the side as the boat rolled. Estimates of the elapsed time between the propeller becoming fouled and the boat capsizing ranged up to 10 minutes. When and how the fish eventually became detached from the boat is not known.

### 3.3 Post Accident

Following the capsizing, the boat floated inverted, down slightly by the stern, and with the bottom of the hull out of the water. The three men climbed onto the hull and sat toward the bow to give the boat a level trim. There were no other vessels within sight. Various items of gear and equipment sunk or went adrift when the boat capsized. Inasmuch as the door of the distress flares locker could not be latched and would likely open when the boat overturned, the owner presumed that they were lost. (During examination of the boat two weeks after the accident, the flares were found to be in place. All three failed to light, however, most likely due to salt water exposure following the accident.) The food and water on board were among the items that were lost. Shortly after they had all climbed onto the boat after the capsizing, the owner's son spotted the water container floating nearby and volunteered to swim over and retrieve it. His father would not allow anyone to leave the safety of the boat, though, and also vetoed the boys' plan to try and right the overturned boat.

Having taken off their clothes earlier due to the spray, the owner and his son had little protection from the sun: the owner had a pair of shorts and a shirt, his son had only a pair of shorts. The nephew was dressed in light clothes, including sneakers. The only occupant injured in the actual swamping and capsizing was the owner: he was bleeding and in pain from the fishhook wounds. He claimed nevertheless to have been the calmest of the three and to have tried to ease the boys' apprehension by assuring them that they would eventually drift through other popular fishing areas.

As the afternoon wore on, and no other boats were sighted, the owner made plans for the possibility that they would spend the night on the ocean. Although they wore PFDs at all times following the accident, he was concerned that sharks would be attracted by the blood and attack anyone who might fall overboard. He discussed a point by point plan with the boys whereby one of them would swim under the overturned boat and retrieve the line from the bow

locker. His nephew volunteered and accomplished the task after several attempts. The owner then rigged the line along the length of the hull as a lifeline. One end was secured to the bow eye, the other to a stern fitting. He did in fact fall off the boat twice while rigging the line, but once it was up each man looped an arm or leg through it and managed to stay on the boat until rescued.

During the evening and night, the owner frequently bathed his feet to try and keep down the infection. The boys asked him to keep his feet out of the water, but did not mention the reason: the shark(s) in the area which he had not noticed. The owner had become sunburned during the day, and at night was cold and cramped, sweating, seasick, hallucinating, and generally going more and more into shock. The boys had some of these complaints, but to a lesser degree. To keep awake, the owner pinched the wounds on his feet and the boys slapped each other. Despite these conditions and the lack of vessel sightings, the three did not panic.

At about 0830 the next morning, a U.S. commercial fishing vessel was sighted. (It was about 100 ft (30.5 m) in length and radio equipped.) It happened to be transiting the area, and its crew was not aware that there was a distressed boat in the vicinity. The two younger men attracted its attention by standing and waving their orange PFDs. After the men were taken on board, their boat was recovered, so as not to be a hazard to navigation. In the process of lowering the boat, some component of the lifting system failed. The fiberglass boat fell several feet onto the deck, resulting in major hull damage. The fishing vessel's captain was said to have fixed the recovery site at about 70 NM (113 km) southeast of Cape May. The Coast Guard was notified of the situation by radio, and a patrol boat was dispatched to rendezvous with the fishing vessel. The patrol boat transported the injured man and his son to a waiting ambulance; the nephew rode the fishing vessel into Cape May. The injured boat owner was hospitalized for one day, and then released to convalesce at home.

### 3.4 Time Sequence of Accident Events

- 0830 - Departed marina for fishing area
- 0845 - Arrived at fishing area
- 0845-0945 - Troll fished at idle speed
- 0945 - Moved to different fishing area
- 1000 - Arrived at second fishing area
- 1000-1100 - Troll fished at idle speed
- 1100 - Large fish struck two lines causing lines to become tangled
- 1100-1125 - Tried to reel fish into boat
- 1125 - Fishing line became entangled in port props; water observed in aft end of boat
- 1125-1130 - Occupants tried to stop ingress of water
- 1130 - Attempted to start engines without success
- 1130-1135 - Occupants attempted to bail water out of boat
- 1135 - Distress call made on marine radio
- 1135-1137 - Occupants donned PFDs
- 1137 - Occupants moved forward to stop ingress of water over transom; boat capsized
- 1137-1139 - Occupants climbed on top of capsized boat
- 1139-0830 - Occupants stayed with boat
- 0830 - Capsized boat spotted by commercial vessel
- 0835 - Occupants taken aboard commercial vessel
- 0900 - Occupants transported ashore by Coast Guard vessel

#### 4.0 VESSEL DATA

The boat involved is a 1975 Seacraft SF23 Superfisherman, HIN: SECF30090875. It is constructed of FRP and has a stepped deep-V hull, and a center control console. Its dimensions are 23 ft 3 in. (7.1 m) L x 8 ft (2.4 m) B x 25 in. (0.6 m) transom height. The capacity plate specifies a maximum horsepower of 300, a maximum persons load of 1200 lb (544 kg), and a maximum weight capacity of 3185 lb (1445 kg). From the manufacturer's literature, the hull weight is estimated at 2650 lb (1202 kg). The boat was equipped with two 1976 model Chrysler outboard motors of 135 hp each, which were bolted to the transom. Refer to Figures 1 through 10 for details of the boat's interior and exterior at the time of the investigation. As can be seen, fishing line has fouled the port propeller; the hatch cover over the fuel tank is missing; the unshielded engine control cable cutouts, each 4 in. x 4 in. (10 cm x 10 cm), are only about seven inches (18 cm) above the water line; and more than half of the forward motorwell bulkhead is reduced 8-1/2 in. (22 cm) in height to about 17 in. (43 cm) above the water line when it is folded down.

The boat was equipped with two starting batteries, located in the lower compartment on either side of the fuel tank. An electric bilge pump was also installed in the vicinity of the fuel tank. A current Auxiliary CME decal was displayed on the windshield.

Damage consisted of fractured hull strength members, miscellaneous fiberglass damage, broken or missing deck equipment and fittings, a broken shock bracket on the lower unit of the port engine, and salt water damage to both engines.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

A general lack of care in the operation of his boat seems to be evident on the part of the owner. Specific faults which possibly or actually were present in this case include:

- Failure to leave a float plan
- Incomplete safety equipment
- Over-reliance on others in the maintenance of the boat and failure to make pre-voyage inspections
- Failure to insure that the motorwell panel was kept up and secured, and
- Leaving the controls for an extended period while underway.

In trying to understand this behavior, possible explanations include:

- Perhaps the owner placed too much confidence in the boat itself and did not appreciate the part which safe operation plays in having a successful voyage. He mentioned having purchased this particular boat with safety specifically in mind, but apparently felt that he had invested enough money to prevent the occurrence of this (or most any) sort of accident; and
- The majority of the owner's boating experience had been in a smaller boat and on protected waterways; and hence he may not have fully appreciated the differences in the two situations, especially regarding the larger boat's complexity and the greatly reduced capability for self-rescue in the offshore ocean environment.

A factor which the owner himself identified as a partial explanation of this accident was his excitement concerning the large fish and his consequent lack of attention to the operation of the boat.

## 6.0 PROBABLE CAUSE OF ACCIDENT

Subject to reservations regarding the accuracy of the narrative description of this accident, its chief causes are considered to be the owner/operator's failure to monitor the status of his boat's systems and the action on some occupant's part of shutting down the starboard engine (and therefore, possibly the bilge pump). Major contributing causes (and the water's probable entry paths into the hull) would appear to be the large, low, unshielded control cable openings in the motorwell and the (presumably) folded-down motorwell forward bulkhead.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The boat was not loaded over its capacity plate limit with persons, motors, and gear. It is possible, but not very likely, that there was a significant quantity of water in the lower compartment prior to the beginning of the sequence of accident events which would have resulted in an overloaded condition. It would seem reasonable to conclude that the seas were higher than as reported by the owner. However, the degree to which weather contributed to this accident could not be readily determined.

There is either a discrepancy or information missing as to how the fishing line became tangled in the propeller while the engine was reported to be in neutral.

It might be reasonable to presume that the section of the motorwell bulkhead was folded down after the propeller was fouled, so as to enable the occupants to lean over the stern and assess the situation, although there is no direct evidence to support this view. In any case, it would have been very difficult for an occupant to lean over the stern far enough to cut the fish loose and possibly avoid the capsizing. To cut the line, it would probably have been necessary to enter the water and swim to the stern.

The stoppage of both engines was not explained. It may have been done to avoid fouling the other propeller. In any case, the bilge pump could have been disabled if both ignition switches were left off. (The wiring system was not checked.)

As the occupants were looking over the side and concerning themselves with the fish, the downward pull it exerted combined with the concentration of their weight in the stern to reduce the

freeboard aft to some undetermined extent. Following seas swamped the boat through the control cable cutouts and over the forward motorwell bulkhead, which was likely folded down for whatever reason.

Water entering the lower compartment likely shorted out the starting batteries, making it impossible to restart the engines. Water also accumulated in the cockpit and gave the occupants their first recognized signal of danger. As water continued to fill the lower compartment, normally sealed except at the control cable cutouts, it forced the trapped air upwards through the after hatch, which popped loose. (It was determined that at some previous time the owner did not reseal the hatch with the supplied gasket and screws, preferring instead to have quick and generous access to the fuel tank.) This is not considered a major factor in the accident process, however, because swamping had already proceeded to a dangerous stage.

The eventual capsizing was probably hastened by the occupants standing and rapidly moving around the boat to improve the trim and obtain gear. Their actions following the capsizing, especially involving the lifeline and not leaving the floating boat, greatly improved their chances of survival.

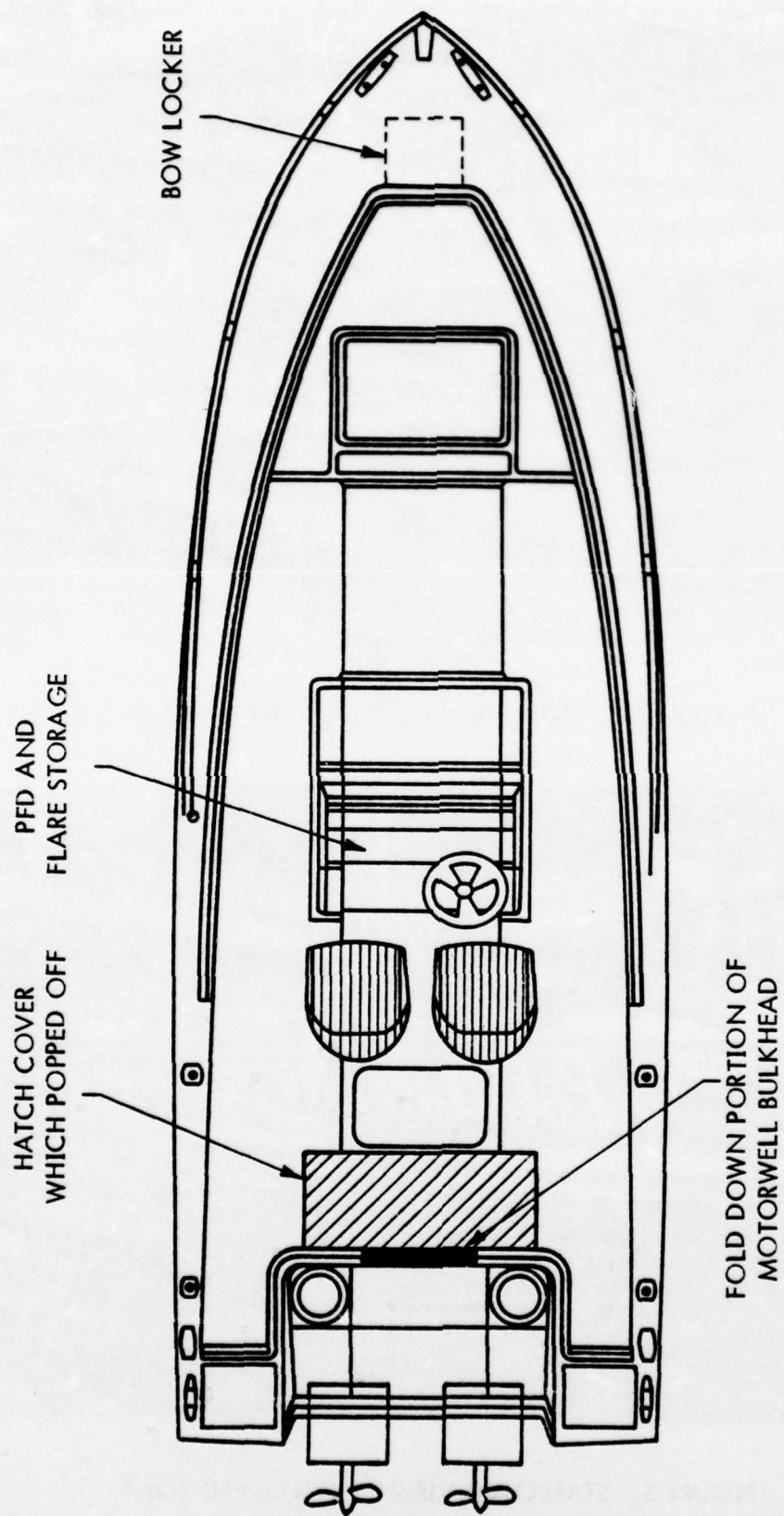


FIGURE 1. SCHEMATIC OF INVOLVED BOAT

N-15



FIGURE 2. PORT VIEW OF INVOLVED BOAT



FIGURE 3. STARBOARD VIEW OF INVOLVED BOAT

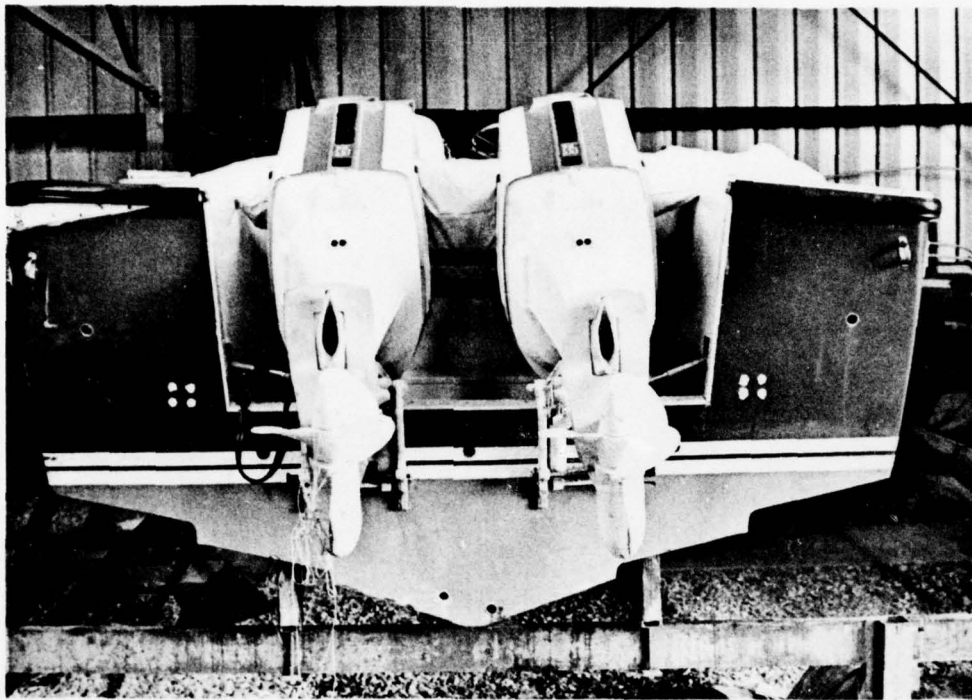


FIGURE 4. STERN VIEW

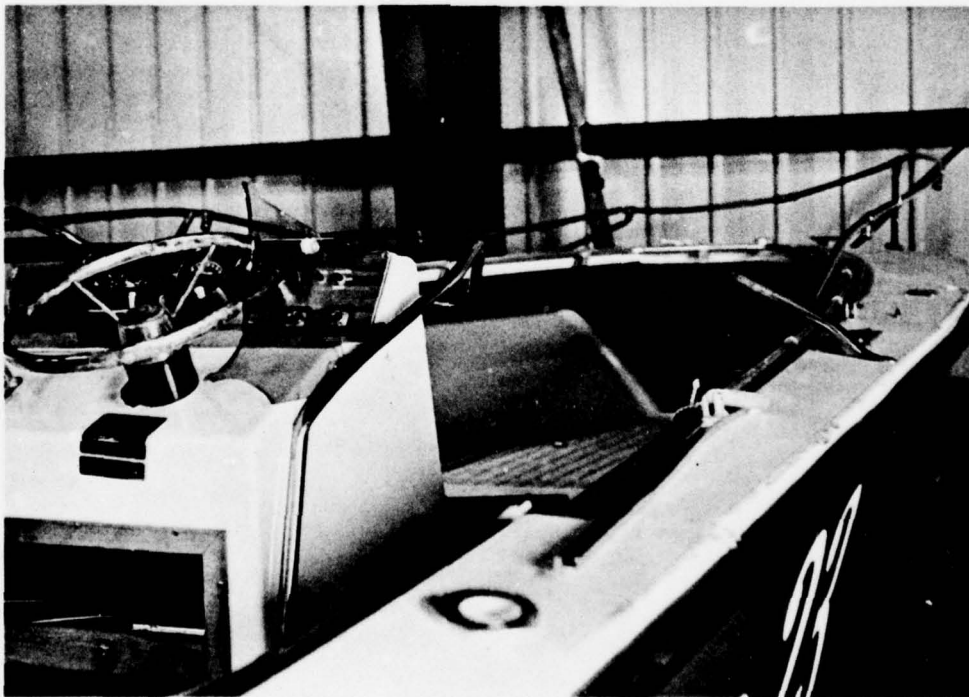


FIGURE 5. STARBOARD SIDE, FORWARD SECTION

N-17

221

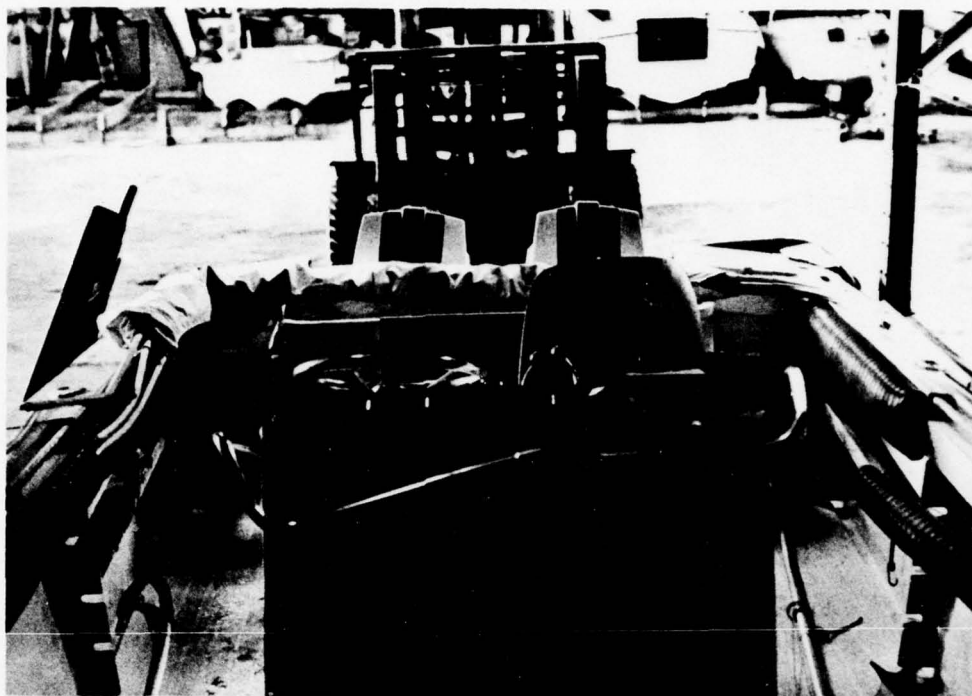


FIGURE 6. CENTER CONSOLE



FIGURE 7. PORT ENGINE. NOTE FISHING LINE IN PROPELLER

N-18

222



FIGURE 8. NOTE FOLDED DOWN MOTORWELL BULKHEAD

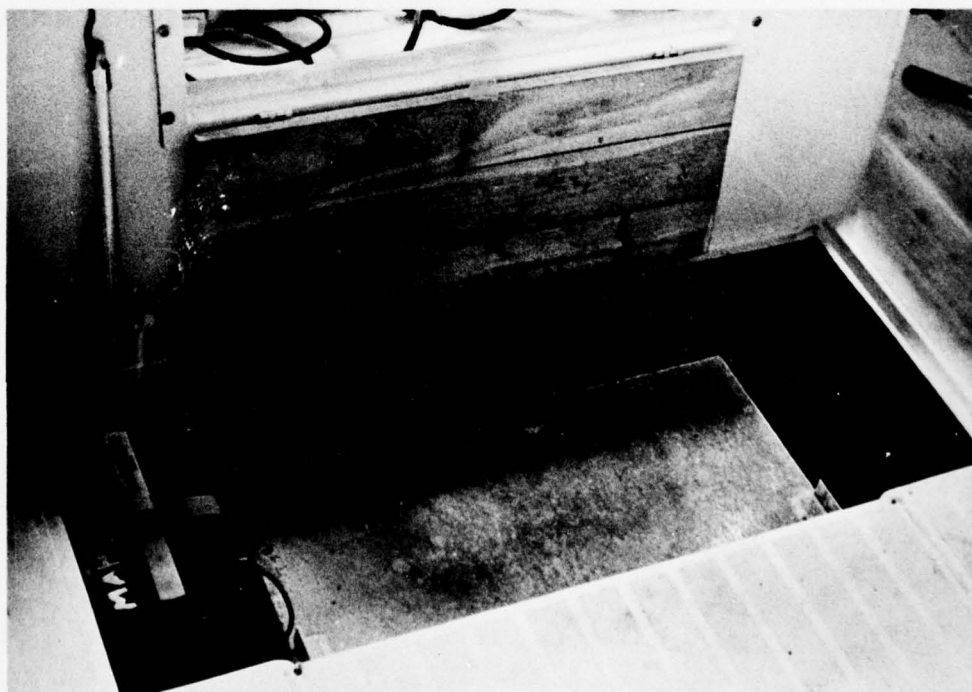


FIGURE 9. FUEL TANK AND BATTERY COMPARTMENT FROM WHICH  
HATCH COVER POPPED OFF

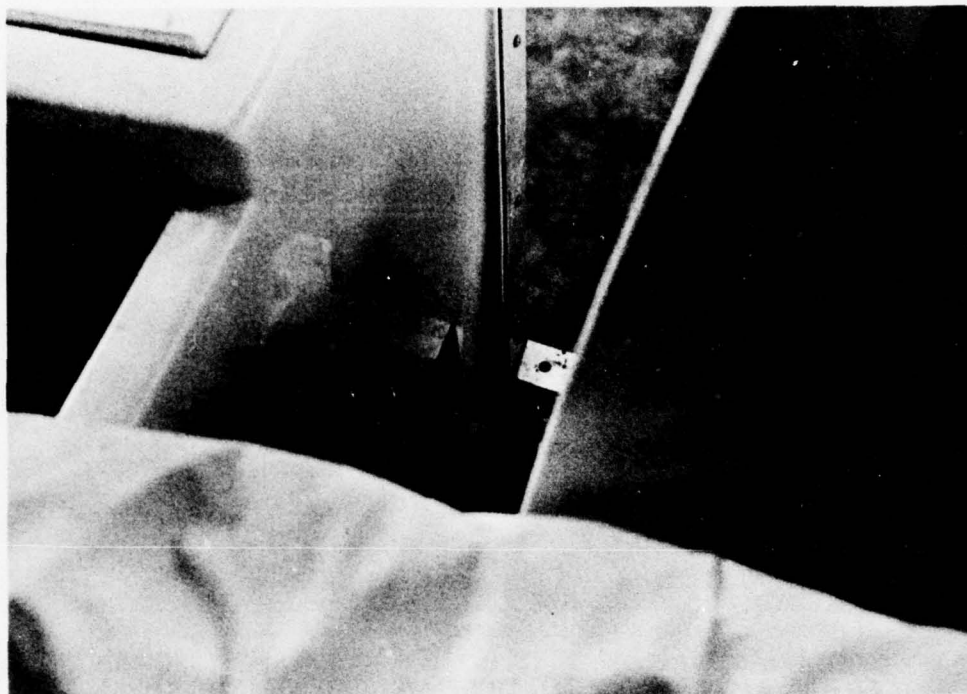


FIGURE 10. DETAIL OF CONTROL CABLE CUTOUT ADJACENT TO STARBOARD ENGINE

N-20

224

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: 14 September 1976

Date of Accident: 11 September 1976

Investigation: Capsizing/Swamping No. 76-15

### SUMMARY — WYLE ACCIDENT NO. 76-537

The accident reported herein involved a 16' 3" (5 m) bowrider runabout powered by a 65 hp outboard motor. The type of accident was a swamping which resulted in no injuries or fatalities.

At about noon on a Saturday, the lone occupant of the bowrider, its 62 year old owner, was drift fishing in Jones Inlet along Long Island, New York's south shore. Wave height was reported to be about 3 to 4 ft (0.9 to 1.2 m). As the boat was drifting with the current and about 100 yd (91.4 m) from the nearest shore, a pleasure cruiser passed close by at a high rate of speed. Its wake swamped the smaller boat over the bow. It filled with water but floated right-side-up and just beneath the surface. The operator remained aboard standing, but did not put on any of several wearable PFDs available. Although there were many other boats nearby, 10 minutes elapsed before anyone responded to his shouts and obvious distress situation. The Coast Guard was called, and a patrol boat arrived on scene shortly afterwards and towed the bowrider to shore.

## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Boating Instruction	PFDs Worn Before	PFDs Worn After
Operator	M	62	230 lb (104 kg)	Good	over 500 hr	None	No	No

The owner/operator is married, a father and grandfather, and employed as a clerk in an unspecified industry. He has lived in the same Long Island suburb of New York for 40 years. He has boated nearby, including at the inlet where the accident occurred, intermittently for about 30 years. The frequency and extent of his recent boating activity were not determined. He appeared to be of average intelligence and physical ability. He claims to have no health problems or physical disabilities. During the interview he was somewhat impatient due to having made other plans for the evening (after he had agreed to the interview appointment). He apparently had other things on his mind; and it is felt that many of his responses were either hasty or defensive. He terminated the session sooner than the interviewer would have liked and before all desired questions were asked.

The owner purchased the boat involved in the accident used three years earlier. He had owned a number of boats over the years, but this was his first bowrider. He said that he never wears a PFD in his boat, although he frequently goes out fishing alone.

## 2.0 ENVIRONMENT

The weather, as reported by the Coast Guard station and patrol boat on scene, was clear skies, visibility 10 miles (16.1 km), winds SSW at 10 knots, wave height 3 to 4 ft (0.9 to 1.2 m), air temperature 70°F (21°C), and water temperature 65°F (18°C). Slack water had occurred about 20 minutes prior to the accident, and the current was beginning to ebb. The water depth in the area varied from 7 to 23 ft (2.1 to 7 m). No small craft warnings were in effect on the day of the accident.

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

All information in the description of this accident was provided by the bowrider's owner/operator, as no other witnesses have been identified.

The owner moors his boat at a marina within two miles (3.2 km) of his home. Prior to departure he listened to the weather forecast on a local radio station, as is his usual practice, and learned that no warnings were in effect. At 0900 he departed to fish for fluke inside Jones Inlet, which is about three miles (4.8 km) by sheltered waterway from the boat's mooring. He did not wear one of the available PFDs at any time during the trip. They were kept on top of the seats in the bow section. The owner reported there to be about 100 other small boats fishing in the area. The method of fishing used is to fish while drifting with the current, and then to power back against the current. The owner said that he did not shut off his boat's engine while drifting. He described the water conditions as "choppy; it wasn't a good day." He said that no water would have been present in the boat because he had used the installed electric bilge pump, which he said was working properly. He mentioned that the boat would usually take on a little water over the transom in choppy conditions. During the morning, he fished without incident. Whether any alcohol was consumed during the trip was not determined.

#### 3.2 Accident

The person and gear on board were distributed as shown in Figure 1, and a diagram of the accident area is shown in Figure 2.

At about 1145 the boat was drifting with the ebbing current and about 100 yd (91.4 m) from the nearest shore. The owner said that the boat's bow was pointing across the inlet. At that time he was seated in the operator's position and was engaged in fishing. A pleasure cruiser, estimated to be 50 ft (15.2 m) in length, then passed close by the bowrider (at a distance of "maybe 25 ft" [7.6 m], according to the operator). The larger boat was transiting the inlet, and was said to be proceeding at a high rate of speed. The cruiser's wake swamped the smaller boat over its bow, almost filling it with water. After a few seconds the operator stood up, but did not make

an attempt to get a PFD. Whether the engine was stopped by the operator or by immersion in the water was not determined.

### 3.3 Post-Accident

The boat filled with water such that it sank almost to the gunwales, according to the operator. After standing up, he moved to the centerline so as to keep the boat from capsizing. He said that, other than for his feet and legs, he did not get wet during the incident. Ten minutes elapsed until any of the numerous boats nearby responded to the obvious distress situation, despite his calls for help. The boat which eventually responded, a small Boston Whaler, took him on board and stood by in the area while another boat notified the local Coast Guard station by radiotelephone. Their patrol boat was on scene within 15 minutes of receiving the call. The bowrider was taken in tow, but overturned enroute to the station. Several items of gear and equipment were thus lost overboard, and the boat sustained some fiberglass damage. It was eventually hauled up on shore.

### 3.4 Time Sequence of Accident Events

- 0900 - Departed for fishing area in Jones Inlet
- 0910 - Arrived at fishing area
- 0910-1145 - Drift fished
  - 1145 - Wake of large cruiser partially swamped boat
- 1145-1147 - Water continued to flow freely over the bow until the boat was completely swamped
- 1147-1157 - Operator stayed in swamped boat calling for help and shifting his weight to keep the boat upright
  - 1157 - Operator rescued by small boat in the area; distress call made to Coast Guard by radio equipped cruiser in the area
- 1212 - Coast Guard rescue vessel arrived on scene and took the involved boat in tow

#### 4.0 VESSEL DATA

The boat is a 1972 Larson model 41605 fiberglass tri-hull bowrider, serial number 11-717200. It is 16 ft 3 in. (5 m) in length, 87 in. (2.2 m) at maximum beam, and 20 in. (0.5 m) transom height. Its capacity plate specifies a maximum persons capacity of 1050 lb (476.3 kg), a maximum weight capacity of 1800 lb (816.4 kg), and a maximum horsepower capacity of 140. The amount and placement of flotation material could not be determined. The boat was powered by an Evinrude 65 hp outboard motor, which was bolted to the transom and controlled by an Evinrude electric throttle/shifter. The boat appeared to be in fair condition except for moderate damage at the hull/deck connection on both bows and a small hole in the hull above the waterline on the starboard bow. All damage was said by the owner to have been sustained during recovery operations following the swamping. He had modified the boat by cutting a 5-1/2 in. x 11-1/2 in. (13.9 cm x 29.2 cm) hole in the motorwell deck to facilitate the installation and maintenance of the electric bilge pump. During examination of the boat, the dry chemical fire extinguisher on board was found to be discharged and in poor condition. Details of the boat's hull, interior layout, damage, and modification are shown in Figures 3 through 8.

#### 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

It was apparent, in addition to the observations made earlier about the owner/operator's attitude, that he disliked being questioned about his accident by a younger person and was quite afraid of being judged as being less than a competent boater. These notions lend further support to the theory that he may have been covering up actions on his part which directly helped cause the accident. The nature of any such actions remains unknown, however, due to the lack of other witnesses to the swamping.

#### 6.0 PROBABLE CAUSE OF ACCIDENT

From the data available, the probable cause of this accident is considered to be the bowrider's inability to handle the large wake from a passing cruiser combined with moderate sea conditions.

## 7.0 DYNAMICS/ANALYSIS OF ACCIDENT

The boat's load of persons, motor, and gear was well below its capacity plate limitation. There is some possibility, however, that enough water was shipped over the transom (and hence into the bilge, because the owner modified the motorwell such that any benefit it may have provided was cancelled) to make the boat more prone to being swamped. This effect would have depended on the extent to which the electric bilge pump was used, which was not able to be clearly determined.

Weather almost certainly played a part in this accident. Not only were the seas moderate for a boat of this size, but the current had recently begun to ebb, which may have caused some difficult conditions. Specifics are again lacking, however, due to lack of cooperation from the owner/operator.

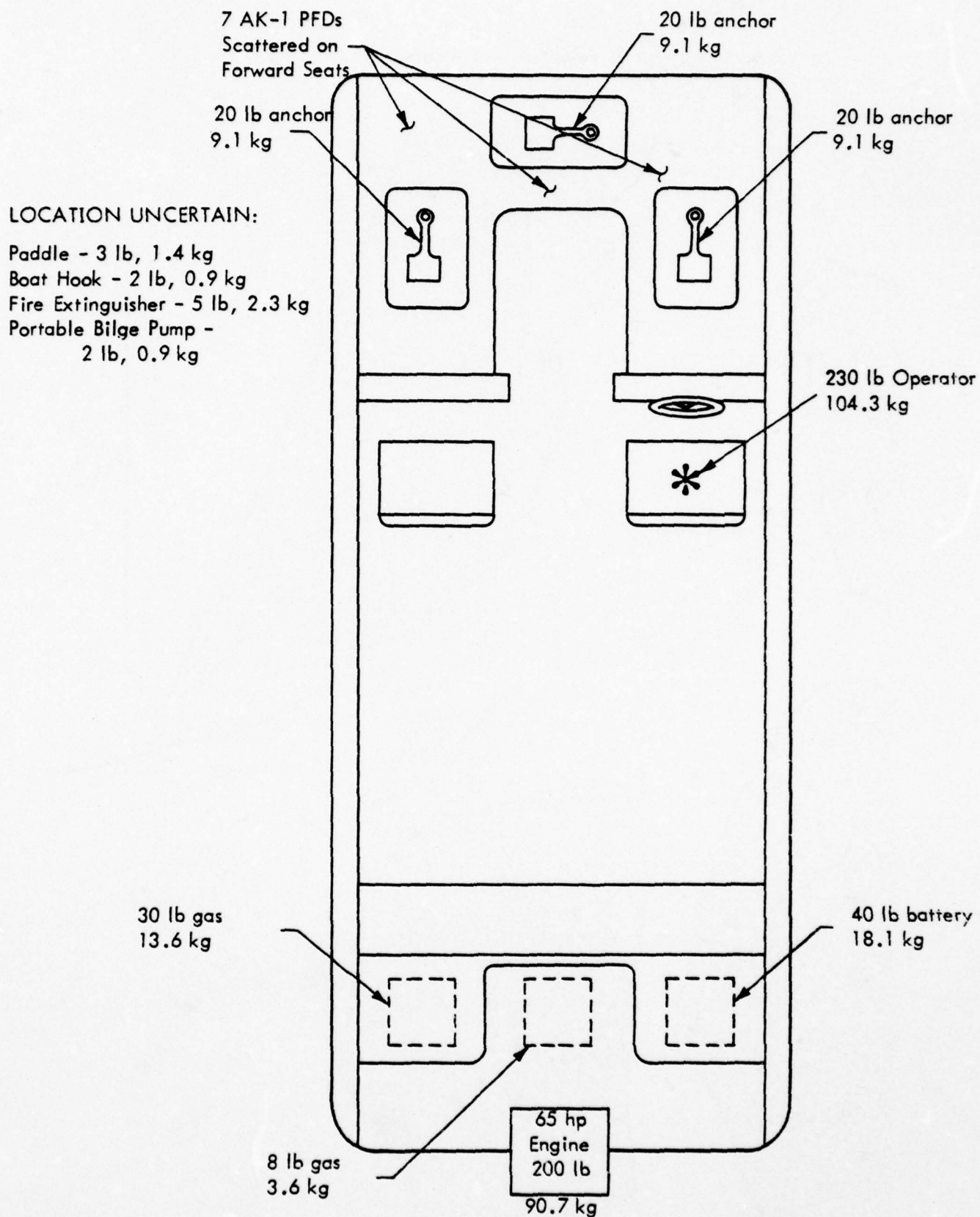


FIGURE 1. LOAD DISTRIBUTION

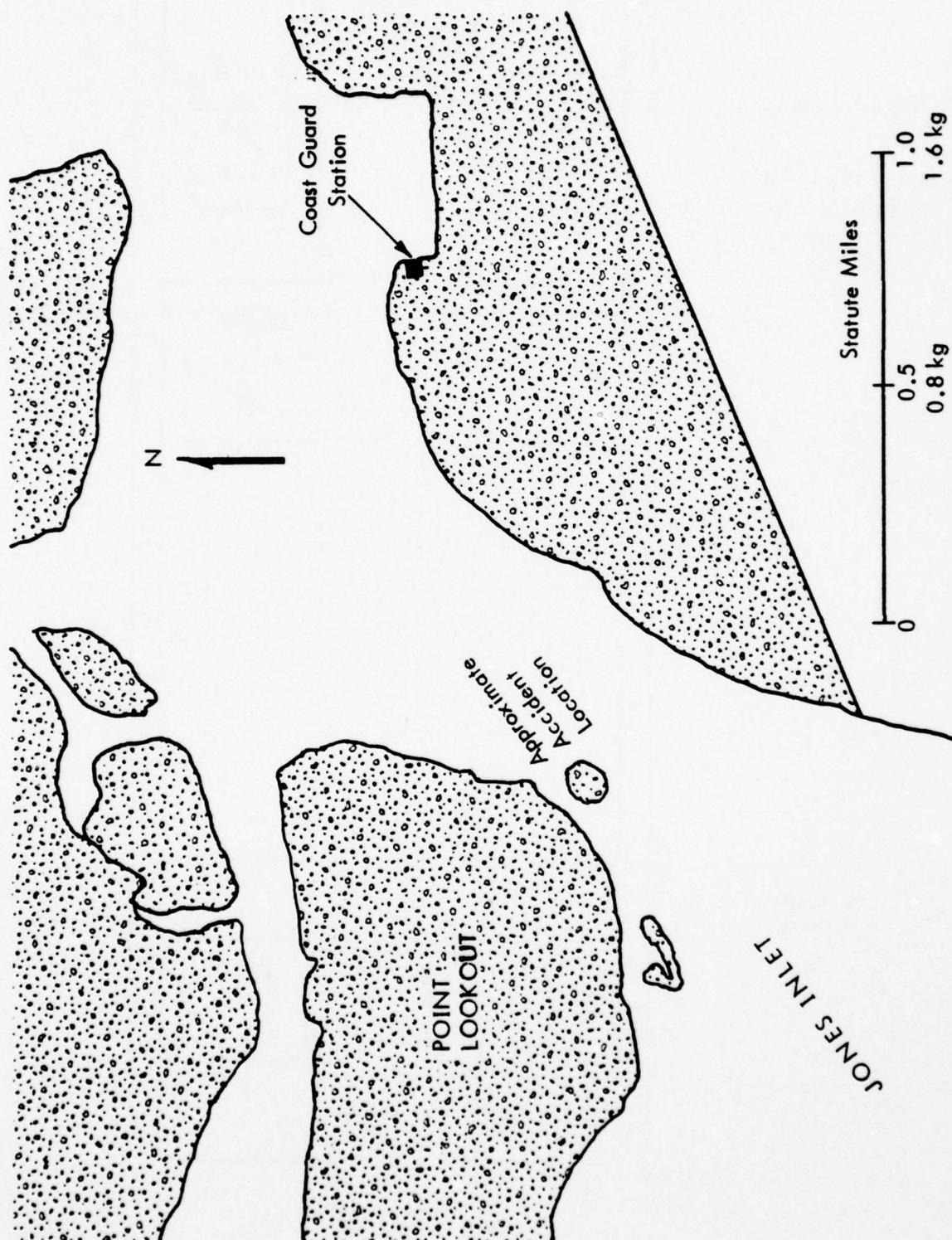


FIGURE 2. ACCIDENT AREA DIAGRAM

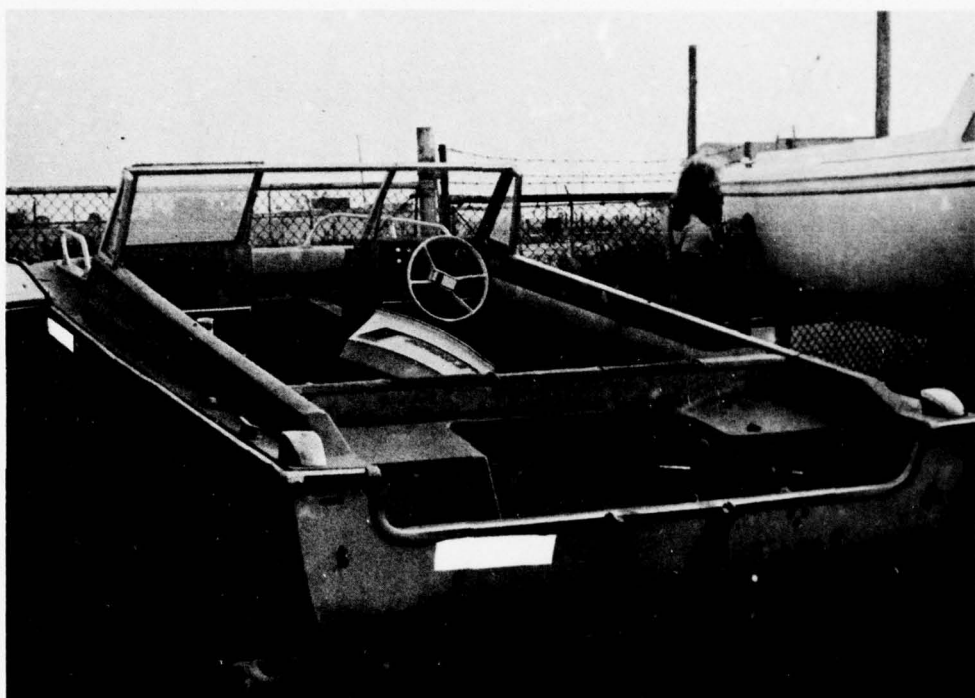


FIGURE 3.

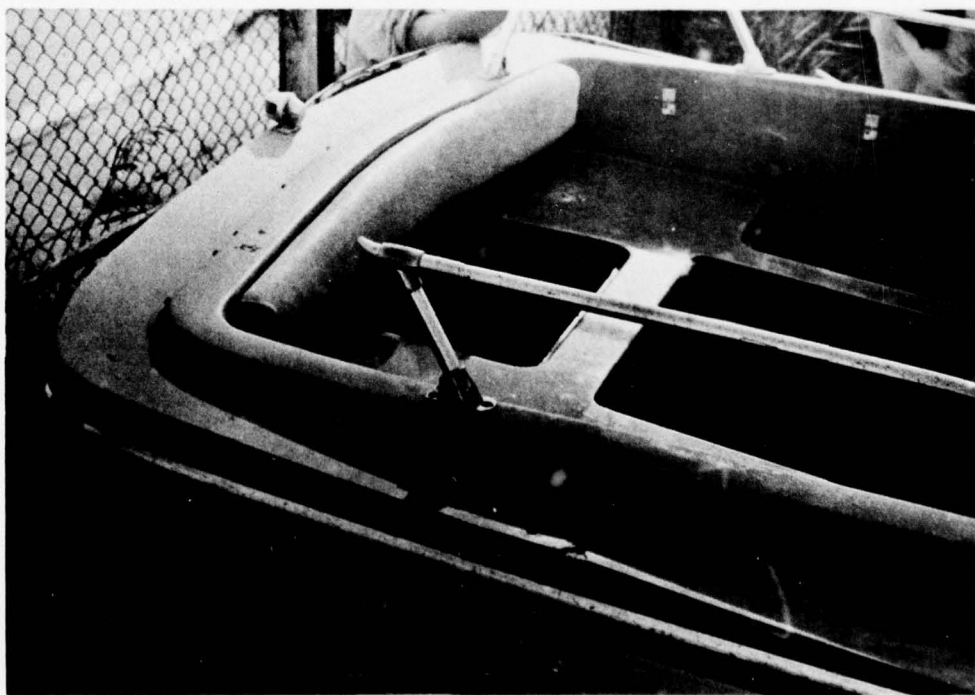


FIGURE 4.

O-9

233

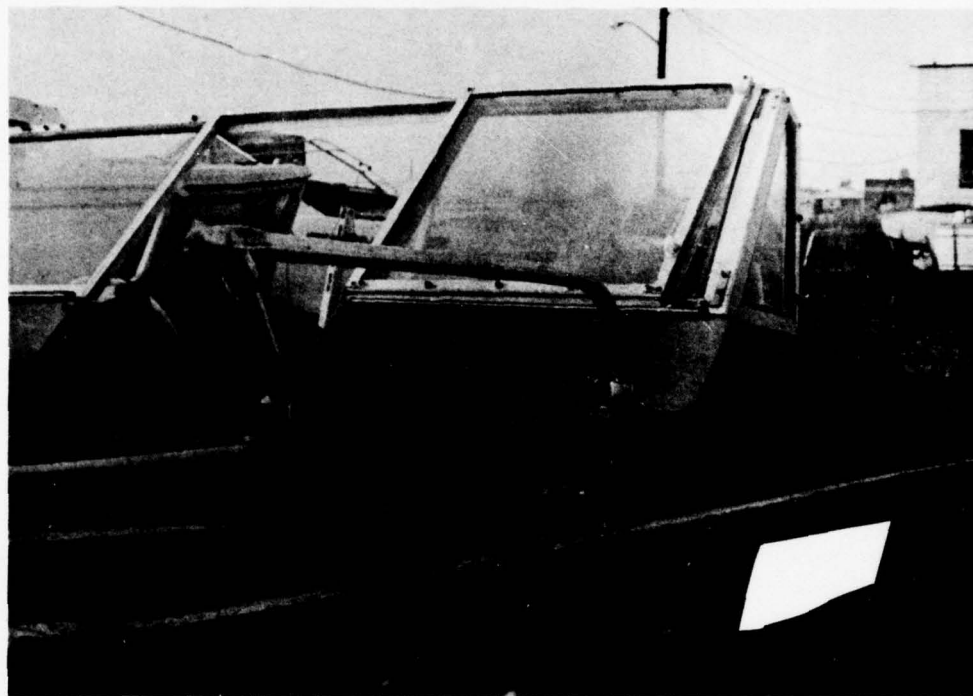


FIGURE 5.

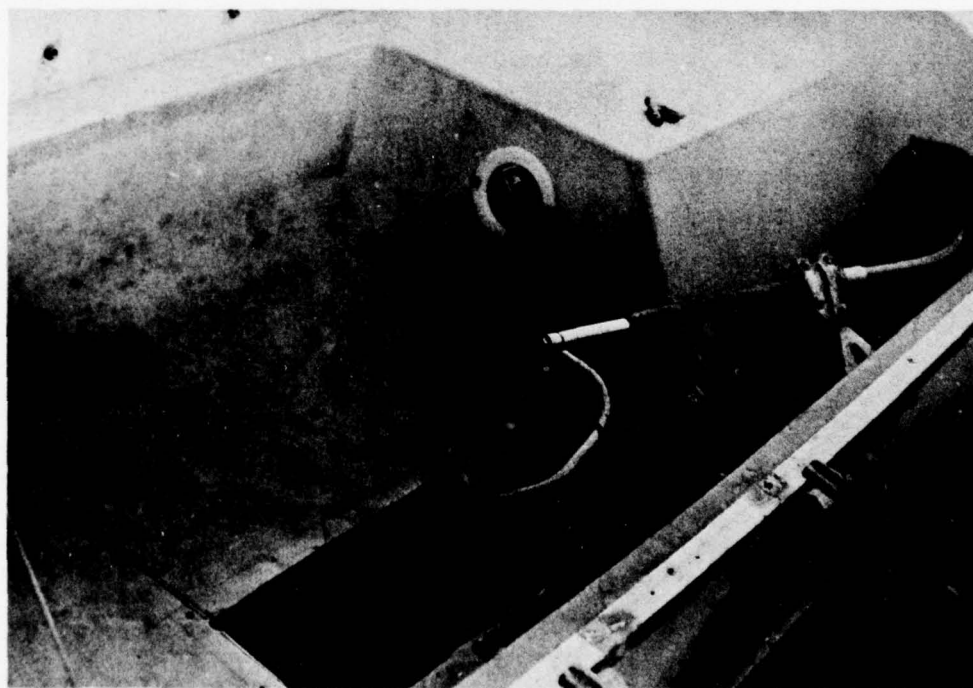


FIGURE 6.

O-10

234



FIGURE 7.



FIGURE 8.

O-11/12

235  
236X

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: October 21, 1976

Date of Accident: September 7, 1976

Investigation: Capsizing/Swamping No. 76-16

### SUMMARY — WYLE ACCIDENT NO. 76-561

The accident reported herein involved a 14-1/2 ft (4.4 m) fiberglass tri-hull bass boat powered by a 65 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1800 on September 7, 1976, three teenage boys were preparing to return from a fishing trip in the Atlantic Ocean near the mouth of the St. Johns River near Jacksonville, Florida. The anchor was pulled in and attempts were made to start the outboard motor. The stern of the boat turned into the wind and waves. While the motor was being started, several waves broke over the transom, partially swamping the boat. Shortly after the motor was restarted, a wave broke over the motor cover, causing the motor to stop from water intake. Waves continued to break over the stern until the transom freeboard was reduced to the point that water flowed freely over the transom into the boat. The boat flooded and capsized, coming to rest in an upside down, near level attitude. The occupants climbed on top of the boat and remained there for approximately two hours until rescued by a Coast Guard vessel.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instructions</u>	<u>PFDs Worn</u>	
							<u>Before</u>	<u>After</u>
Operator	M	19	150 lb (68 kg)	Excellent	500 hrs	None	No	Yes*
Passenger	M	16	140 lb (63.5 kg)	Excellent	200 hrs	None	No	Yes*
Passenger	M	19	150 lb (68 kg)	Good	25 hrs	None	No	Yes*

\* Held to PFD but did not put it on.

### 1.1 Owner/Operator

He was a college student and seemed to be of average intelligence and physical ability. He stated that he had been around small boats all his life and seemed to be knowledgeable concerning the proper operation of small boats. He was very familiar with the waters in the accident area and had fished in that area almost weekly for a number of years. He owned a 12 ft (3.7 m) johnboat which he frequently took fishing in nearby lakes. He seemed to be a responsible individual who would be concerned about the safety of himself and his passengers.

### 1.2 Passenger (2)

He was a high school student and seemed to be of average intelligence and physical ability. He stated that he had been around boats all his life and his knowledge concerning boat operations seemed to be above average for his age. He usually accompanied the operator on fishing trips and was very familiar with the waters in the accident area. He too seemed to be aware and concerned about boating safety.

### 1.3 Passenger (3)

He was not available for interview at the time of the investigation. According to the other occupants, he was a college student and was of average intelligence and physical ability. He had very little boating experience and was not familiar with the waters in the accident area. Most of his boating experience had been as a passenger and not as an operator.

## 2.0 ENVIRONMENT

The sky was cloudy and the wind was from the northeast at approximately five mph (eight kph). The water was choppy (one to two ft (0.3 - 0.6 m) waves) with a strong current and incoming tide. The recorded air temperature was 70°F (21°C) and the recorded water temperature was 65°F (18°C). The water depth at the accident site was approximately 40 ft (12 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

The accident occurred on Labor Day and the three boys were out of school. During the morning it rained and the boys stayed around their homes. At approximately 1400 the rain stopped and (1) called the other two to set up a fishing trip. Passenger (2) arrived at (1)'s house about 1430. (1) and (2) loaded the fishing gear in the boat, connected the boat trailer to (1)'s auto, and left for a launch ramp approximately 45 minutes away around 1445. On the way to the ramp, Passenger (3) was picked up at his home. The party arrived at the launch ramp at approximately 1530. The boat was launched and the party got underway down river toward a fishing area approximately two mi. (3.2 km) away. They arrived at the mouth of the St. Johns River around 1540. The boat was anchored in the ocean approximately 200 yd (182.9 m) out from a jetty. They fished in this location for a short while, then decided to move closer to shore on the outside of the jetty where the water was calmer. At approximately 1800, the party decided to stop fishing and go back in, so they could reach the launch ramp before dark. The fishing gear was stowed and (1) started pulling in the anchor. Several attempts were made to pull in the anchor before it could be broken loose from the bottom. After the anchor was aboard, (2) attempted to start the motor with no success. While attempting to start the motor, the stern of the boat had swung around into the wind and waves, and the boat started drifting toward the jetty. As the boat drifted closer to the jetty where the water conditions were worse, waves started breaking over the transom into the boat until there was about two in. (five cm) of water in the aft section.

#### 3.2 Accident

Gear and people aboard were as shown in Figure 1 and the weather as in Section 2.0.

After several attempts to start the motor, the battery ran down and would not turn the starter. (1) removed the motor cover and was able to start the motor with a pull rope. (2) put the motor in forward gear and started to advance the throttle to get underway. At this time a wave broke over the motor, causing it to stop from water intake. (1) attempted to bail out

the water with the motor cover, but abandoned the bailing operation when water started flowing freely over the transom into the boat. The boat started sinking by the stern and simultaneously started to roll slowly to starboard. (1) told (2) and (3) to move to the centerline and stay in the boat because it had upright and level flotation and would not capsize. The boat continued to roll until the occupants realized it was going to capsize. (1) and (2) each grabbed a life cushion, the rods and reels, and fishing tackle boxes and jumped out over the starboard side. (3) grabbed an AK-1 PFD and jumped over the starboard side.

### 3.3 Post Accident

The boat continued to roll until it was in an upside down, near level attitude. (1) placed the five fishing rods he had salvaged on top of the boat bottom and he and (3) held to the boat. (2), holding a life cushion, two fishing tackle boxes, and five rods and reels was unable to grab the boat and started drifting away. After drifting approximately 30 ft (9.1 m) from the boat, he released the fishing tackle boxes and managed to get back to the boat. He placed the rods and reels on the boat bottom and held to the boat for support. The three discussed leaving the boat and swimming approximately 3/4 of a mi. (1.2 km) to a sandy beach, but decided against it when they realized the boat was drifting into the mouth of the river and would eventually drift ashore. The boat drifted around to the inside of the jetty and started drifting slowly up river. (1) swam under the boat several times to search for loose articles that might be under the boat. Approximately one hour after the capsizing, the occupants climbed on top of the boat. The boat was very stable and supported their weight easily. At one point the three tried to right the boat by shifting their weight to one side, but were unsuccessful.

At approximately 1945 the capsized boat was spotted by a large seaward bound commercial vessel. A crewman on the commercial vessel shouted to the occupants that the Coast Guard had been called and would rescue them in a short time. A Coast Guard vessel arrived around 2000 and located the capsized boat with the aid of a search light. The occupants and the gear they had salvaged were taken aboard the C. G. vessel. The involved boat was righted, evacuated of water, and towed back to the launch ramp by the C. G. vessel. Refer to Figure 2 for sketch of accident area.

### 3.4 Time Sequence of Accident Events

1445	Left (1)'s home for launch ramp.
1530	Arrived at launch ramp.
1535	Departed launch ramp for fishing area.
1540	Arrived at fishing area.
1540-1800	Fished near the jetty.
1800-1802	Anchor retrieved and boat started drifting toward jetty.
1802-1804	Attempted to start motor. Waves broke over transom, partially swamping boat.
1804-1806	Manually started motor. Wave broke over motor, causing it to stop.
1806-1807	Boat swamped and capsized.
1807-1809	Occupants placed salvaged gear on boat bottom and held to boat for support.
1815	Boat started drifting around to inside of jetty and up river.
1915	Occupant got on top of boat and attempted unsuccessfully to right boat.
1945	Capsized boat spotted by commercial vessel; C.G. called.
2000	C. G. boat arrived and took occupants aboard.

#### 4.0 VESSEL DATA

The boat was a 14-1/2 ft (4.4 m), 1973 model Fabuglas bass boat powered by a 1973 65 hp Evinrude outboard motor. It was a tri-hull of fiberglass construction. The capacity plate attached to the boat specified a maximum horsepower capacity of 65, a maximum persons capacity of 600 lb (272 kg), and a maximum weight capacity of 1100 lb (499 kg). The capacity plate also contained the following statement (see Figure 3):

Compliance with the Following U. S. Coast Guard Requirements and BIA  
Recommendations Is Verified

- Load and HP Capacity
- Level Flotation
- Navigation Lights
- Steering System
- Compartment Ventilation

Additional data obtained during examination of the boat were as follows:

- Model No. — TRI-146
- Maximum Beam at Gunwale — 66 in. (1.7 m)
- Maximum Transom Width — 63-1/4 in. (1.6 m)
- Depth Amidships — 20 in. (0.5 m)
- Transom Height — 20-1/4 in. (0.5 m)
- Hull Weight — 910 lbs (412.8 kg)
- HIN — FAB0298M73H

There was very little damage to the boat as a result of the accident. The helm seat had been removed and replaced with a folding lawn chair to provide more room for fishing. A two in. x four in. (5.1 cm x 10.2 cm) hole had been cut in the deck on the left side of the steering console by the previous owner. The hole was either cut to install a forward bilge pump or to provide a drain for the forward section of the passenger compartment (see Figures 4 and 5). Overall boat views are shown in Figures 6, 7, and 8.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator had been out many times in the involved boat in water conditions that were as bad or worse than those existing on the day of the accident. He was confident in his ability to operate the boat and was confident that the boat was safe. He stated that he was certain the boat would not capsize if flooded and was very surprised when it did. He commented that his "decision to purchase the boat was based on the assumption that the boat was U. S. Coast Guard certified for upright and level flotation." Had the amount and placement of flotation material in the boat been in accordance with proposed Coast Guard flotation standards, it would have most likely remained upright and level after it swamped. It is easy to understand how the operator misinterpreted the wording on the capacity plate concerning flotation. The wording is such that one cannot distinguish between Coast Guard requirements and BIA recommendations. Current regulations allow for additional information on the capacity plate after the Coast Guard Capacity Information. For clarity, if additional information is to be displayed, Coast Guard regulations and compliance with recommendations from states or organizations should be separated.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident.

- Failure of the motor to start, allowing the boat to drift into rough water is considered the major contributing factor. With a proper operating motor, this boat most likely could have been safely operated in the water conditions that existed at the time of the accident.
- Pulling in the anchor before the motor was started is considered a factor. The anchor should have been retrieved after the motor was started and the operator was reasonably sure it would continue to run satisfactorily.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The following is presented, based on the narrative, and a knowledge of the boat characteristics.

According to the operator, the inner hull plugs were out at the time of the accident. He stated that he purposefully removed the plugs to allow the water in the inner hull to drain to the stern where it could be pumped out by the bilge pump. Water that came over the transom ran into the inner hull through the drain holes, helm seat mounting holes, and the cutout at amidships. When water became visible in the aft section of the boat, the inner hull contained enough water to significantly reduce the transom freeboard. Waves continued to break over the stern until the freeboard was reduced to the point that water flowed freely over the transom, completely swamping the boat. As the boat started to sink, the flotation material installed in the inner hull caused the boat to have a natural tendency to roll. There was no flotation material installed above deck level. With all the flotation material in the bottom, the boat became very stable in an upside down attitude.

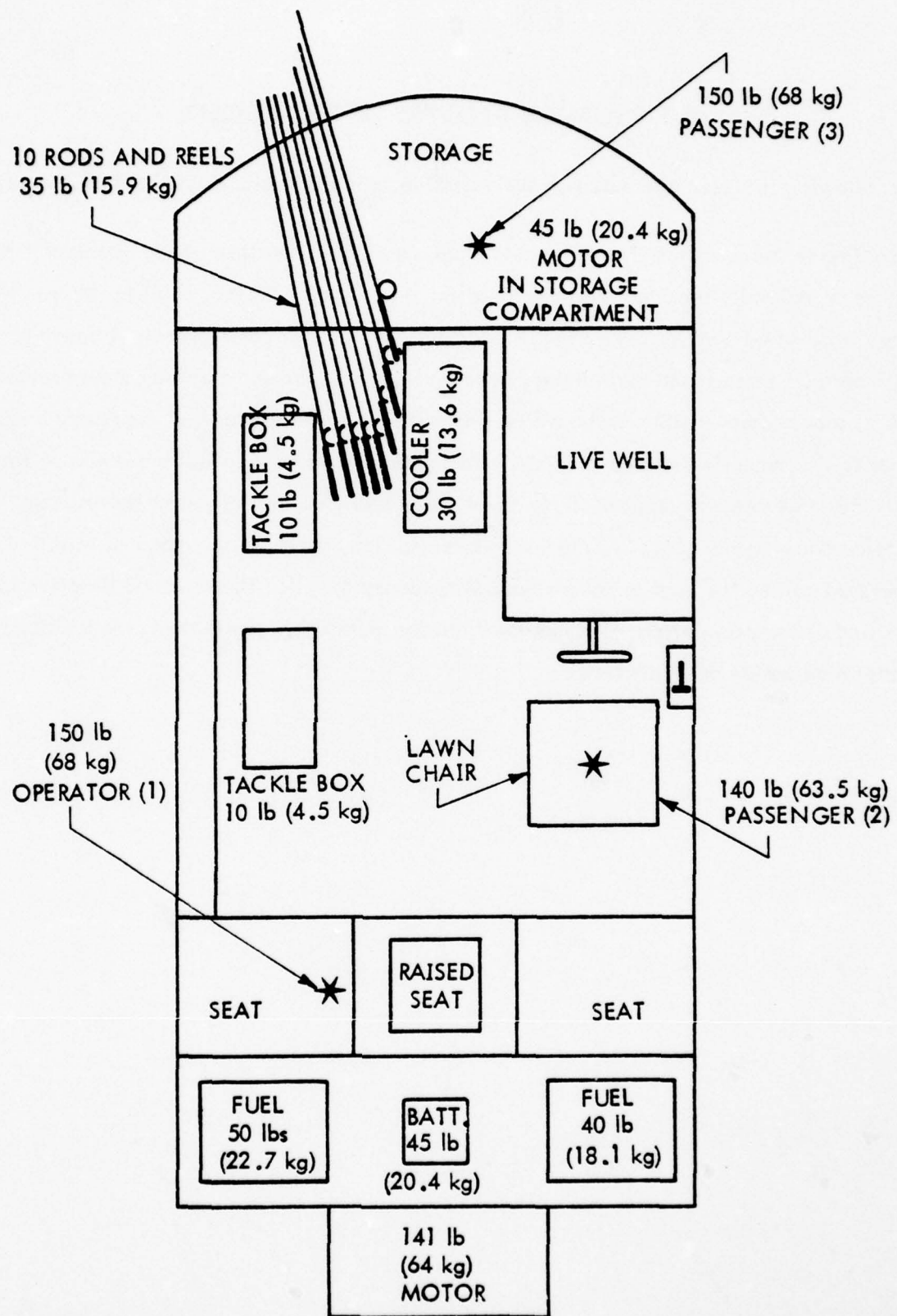


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

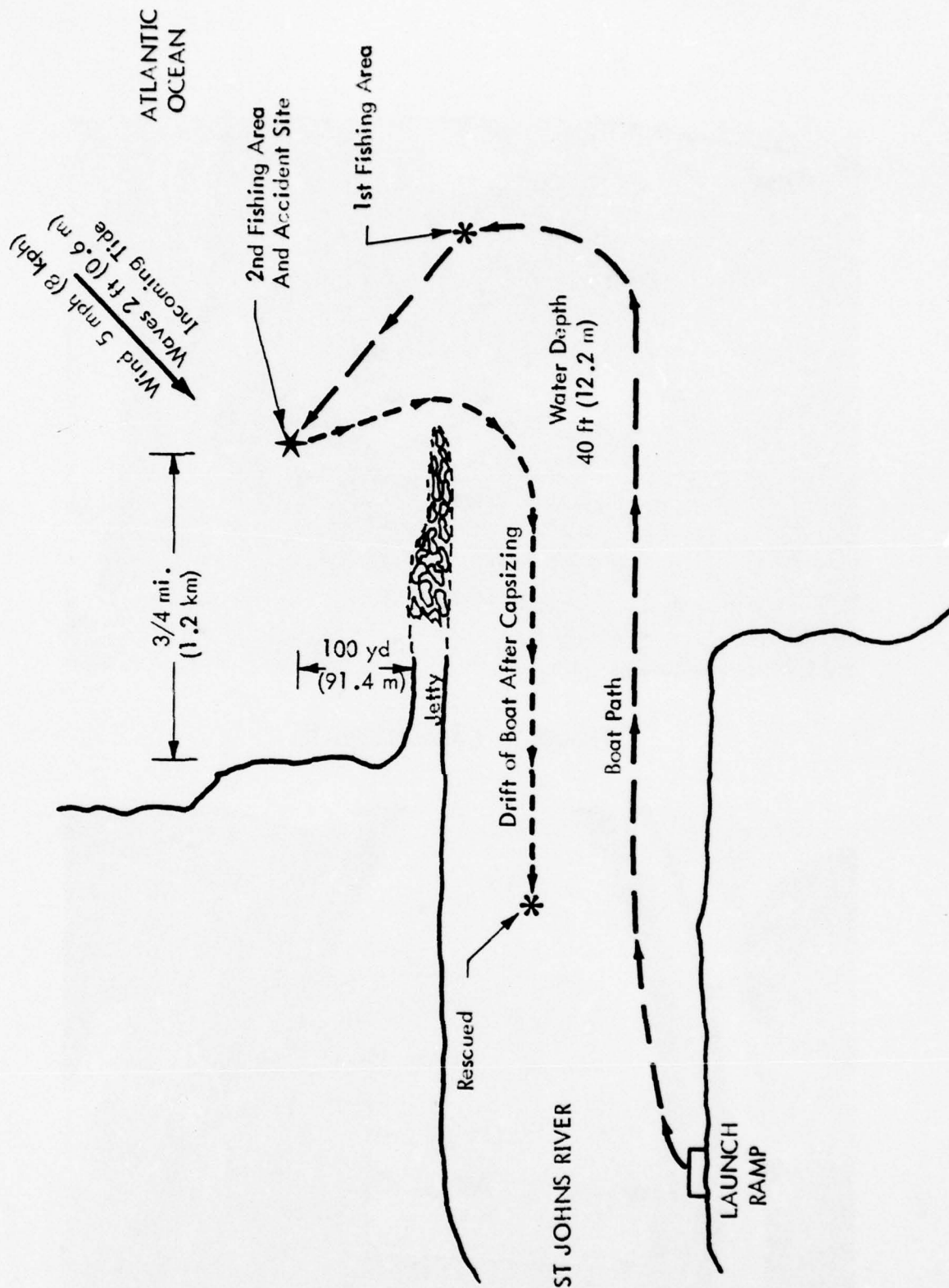


FIGURE 2. SKETCH OF ACCIDENT AREA



FIGURE 3. CAPACITY PLATE

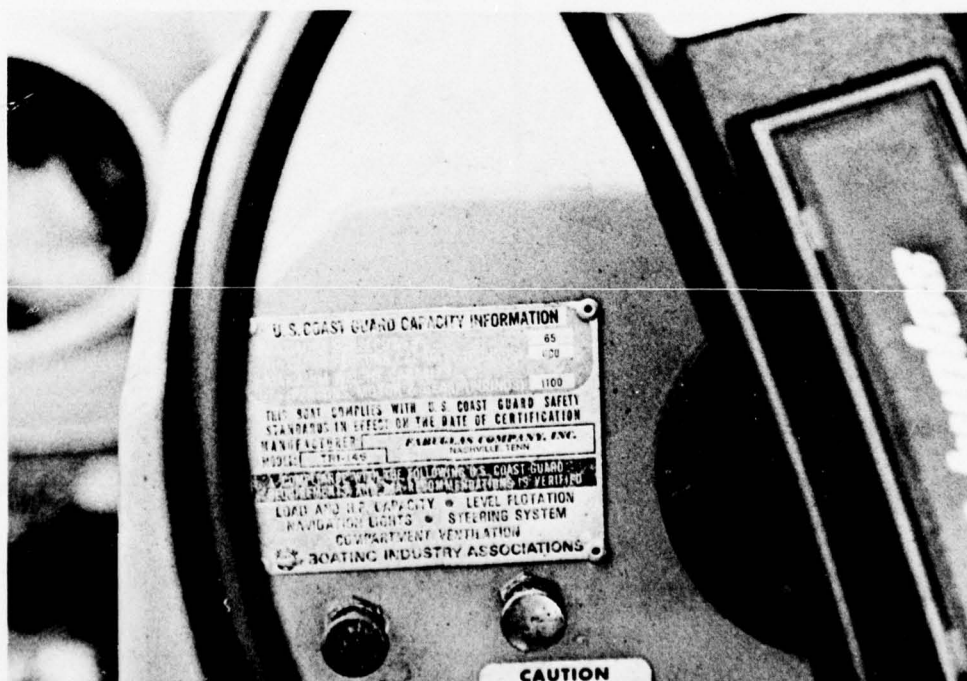


FIGURE 4. CUTOUT FOR BILGE PUMP OR DRAIN



FIGURE 5. CUTOUT FOR BILGE PUMP OR DRAIN



FIGURE 6. SIDE VIEW

P-13

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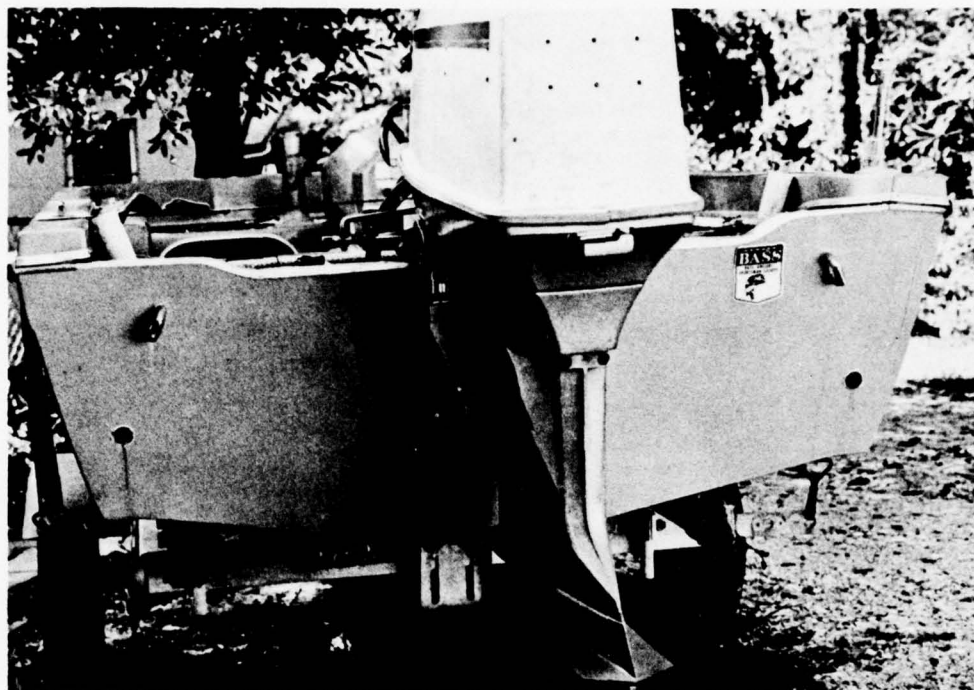


FIGURE 7. STERN VIEW

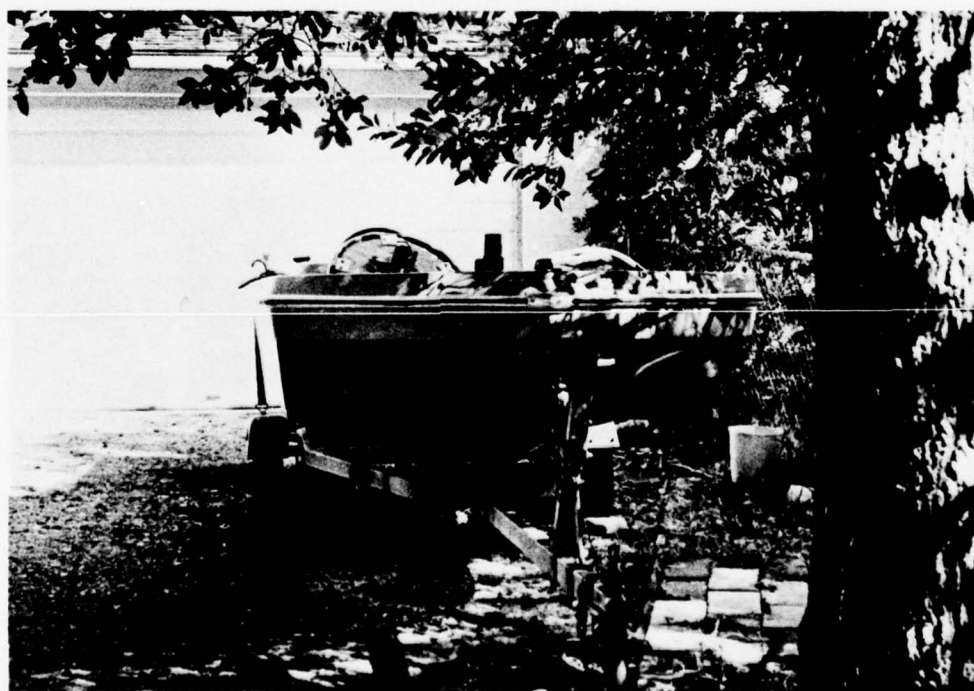


FIGURE 8. BOW VIEW

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: October 21, 1976

Date of Accident: October 8, 1976

Investigation: Capsizing/Swamping No. 76-17

### SUMMARY — WYLE ACCIDENT NO. 76-592

The accident reported herein involved a 15 ft 1 in. (4.6 m) tri-hull open runabout powered by a 25 horsepower outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1200 on October 8, 1976, six adults (three males and three females) were returning from a scuba diving outing near Alligator Reef in the Gulf of Mexico, south of Islamorada, Florida. The party had been diving from a rented boat for about 1-1/2 hrs and had just gotten underway back toward their motel in Islamorada. The boat was traveling approximately five mph (eight kph) over two to three ft (0.6 - 0.9 m) rolling swells and a following sea. As the boat rode up over a wave, the wave velocity increased, causing the boat to surf on the face of the wave in a bow low attitude. The boat then went into the trough and sliced bow on into the next wave, flooding the passenger compartment. Immediately after swamping, the boat rolled to port until it was in an upside down, near level attitude. As the boat rolled, the occupants got out over the port side. The occupants held to the boat for approximately 1-1/2 hrs before being rescued by two 16 ft (4.9 m) runabouts. The boat was towed to the marina and rental agency by a Coast Guard boat.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn</u>	
							<u>Before</u>	<u>After</u>
(1) Operator	M	27	185 lb (84 kg)	Excellent	>200 hrs	None	No	No
(2) Passenger	M	23	140 lb (63.5 kg)	Excellent	>500 hrs	None	No	No
(3) Passenger	F	21	120 lb (54.4 kg)	Good	>200 hrs	None	No	*Yes
(4) Passenger	F	21	120 lb (54.4 kg)	Excellent	Little	None	No	*Yes
(5) Passenger	M	24	155 lb (70.3 kg)	Excellent	>200 hrs	None	No	*Yes
(6) Passenger	F	20	130 lb (59 kg)	Fair	Little	None	No	*Yes

\* Put on buoyant top of wet suit.

All the occupants were high school graduates and seemed to be of average intelligence and physical ability. (1) and (2) owned and operated small closed bow runabouts and (5) owned and operated a cabin cruiser. (3) was the only female aboard that had boat operating experience. This trip was the first time any of the occupants had been out in a small open boat. They were not familiar with the handling characteristics of this type boat.

## 2.0 ENVIRONMENT

The sky was clear and the visibility was estimated to be eight miles (12.9 km). The wind was from the south at 7-14 mph (11.3 - 22.5 kph), and the seas were two to three ft (0.6-0.9 m) rolling swells with an incoming tide. The recorded air temperature was 84°F (29°C), and the recorded water temperature was 78°F (26°C). The water depth at the accident site was about 40 ft (12.2 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

The three married couples involved in the accident lived in Orlando, Florida and had planned a vacation in the Florida Keys. On October 7, 1976, the party drove to Islamorada, Florida, checked in a motel, and checked several places to rent a boat for a scuba diving outing the next day. They found the size and rental price boat they wanted and made arrangements to pick it up the next day. On October 8, 1976, (1) and (2) drove to the boat rental agency to get the boat. Before they were allowed to take out the boat, (1), as the operator, was required to sign an agreement which supposedly released the rental agency of any liability in case of accident. The agreement also specified a maximum persons capacity of 4. The boat owner rented four AK-1 PFDs to the men which they stowed in the live well. (1) and (2) departed the marina at 0910 destined for the motel dock approximately one mi. (1.6 km) away where they were to meet the other members of the party. After getting underway, the men found that the boat would not go fast enough to get on plane. They decided that the motor probably had a governor installed and that was the reason for the slow speed. (1) stated that the boat felt very heavy and sluggish. They arrived at the motel dock about 0920, ate breakfast, and loaded four sets of scuba diving gear aboard. The party left the motel ramp at approximately 1000 destined for Alligator Reef located about four mi. (6.4 km) out in the gulf.

They arrived at the reef at around 1030, anchored the boat, and began diving in the reef area. At approximately 1200, the occupants noticed that the wave heights had increased from nearly six in. (0.2 m) to two to three ft (0.6 - 0.9 m) and decided they had better start back to the motel ramp before the swells got higher. The diving gear was stowed and the party got underway at a speed of approximately five mph (eight kph). (1) stated that he did not feel he could safely negotiate the waves at a speed faster than five mph (eight kph).

### 3.2 Accident

People and gear aboard were as shown in Figure 1 and the weather was as noted in Section 2.0.

After traveling approximately 100 yd (91.4 m), the boat rode up over a wave and was momentarily pushed along on the face of the wave in a surfing manner. The boat then continued down the wave to the trough and sliced bow on into the next wave, swamping the boat over the bow. As the bow went into the trough, (1) reduced the throttle to idle and when he saw water coming over the bow, he stopped the motor. The boat immediately rolled to port until it was upside down in a slightly bow high attitude. As the boat rolled, all the occupants exited the boat over the port side.

### 3.3 Post Accident

At the time the boat capsized, (1) and (2) were wearing only bathing suit trunks; (3), (4), and (5) were wearing bathing suits and wet suit tops; and (6) was wearing a bathing suit and scuba vest, which she inflated as she went out of the boat. When the boat rolled, the anchor fell out with the anchor line tied to the bow. The anchor caught and held the boat in the accident area. The occupants held to the boat and alternately got on the boat bottom, stood up and waved at distant boats for help. The boat was very stable and the people had no trouble holding to the sides. After several attempts to attract other boats, the occupants discussed one person swimming ashore for help. (1) told the other occupants to stop the discussion, because they were going to stay with the boat until rescued. The other occupants agreed that it would be safer to stay with the boat.

Approximately 1-1/2 hrs after the capsizing, the involved boat was spotted by the occupants of a 16 ft (4.9 m) runabout. When the involved boat was first sighted, it appeared normal; however, a closer look with the aid of binoculars revealed that it was capsized. The runabout immediately came to the scene and took the female passengers aboard. (1) told the operator of the runabout to take the women ashore where they could contact the Coast Guard and the men would stay with the boat until Coast Guard rescue arrived. The women were taken to their motel where they notified the Islamorada C. G. The C. G. immediately dispatched a rescue vessel to the accident location.

Shortly after the runabout left for shore, a second 16 ft (4.9 m) runabout spotted the involved boat and came to the scene. When the boat capsized, the four sets of scuba gear fell out of the boat and sank. With the aid of scuba gear on the runabout, the four sets were retrieved and put aboard the runabout. The men and gear were then taken to the motel dock. When the C. G. rescue arrived on the scene, all the occupants of the involved boat were gone. The rescue vessel crew righted the involved boat, pumped out the water, and towed it to the rental agency. Refer to Figure 2 for sketch of the accident area.

#### 3.4 Time Sequence of Accident Events

0910	(1) and (2) left marina for motel dock.
0920	Arrived at motel dock.
0920-1000	Occupants ate breakfast and loaded scuba gear aboard.
1000	Departed for Alligator Reef.
1030	Arrived at reef and anchored boat.
1030-1200	Occupants dived in the reef area.
1200	Got underway back to motel dock.
1201	Boat swamped and capsized.
1201-1202	Occupants got to boat and held onto sides.
1202-1330	Occupants held to boat.
1330	Capsized boat spotted by runabout. Female occupants taken aboard and transported ashore.
1335	Second runabout arrived at accident location.
1335-1345	Male occupants searched for and recovered diving equipment.
1400	Female occupants reached shore and called Coast Guard. Coast Guard dispatched rescue vessel.
1415	Male occupants arrived at motel dock.
1415	Coast Guard vessel found capsized boat.

#### 4.0 VESSEL DATA

The boat was a 15 ft 1 in. (4.6 m) 1965 model Woodson open fishing boat powered by a 25 hp 1975 Evinrude outboard motor. It was a tri-hull of fiberglass construction. There was no capacity plate attached to the boat. The following additional information was obtained during examination of the boat:

- Manufacturer — Florida Fiberglass Co., Coral Gables, Florida
- Serial No. — RR56-90
- Max. Beam at Gunwale — 67 in. (1.7 m)
- Max. Beam at Chine — 57 in. (1.4 m)
- Max. Transom Width — 66 in. (1.7 m)
- Depth Amidships — 21 in. (0.5 m)
- Transom Height — 15 in. (0.4 m)
- Bilge Construction — Seven in. (0.2 m) depth false bottom with no motor well.

The boat appeared to be in very good condition and no evidence of damage resulting from the accident could be found. Refer to Figure 3-6 for overall boat views.

#### 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

Three of the male occupants and one of the female occupants were experienced boat operators. However, none of them had operated a boat of the type involved in the accident. They rented the boat and were not "checked out," concerning its operation before they went on the trip. The major difference in the involved boat and the boats they had operated was the involved boat did not have remote steering. The technique for control of a boat with remote steering is very different than controlling one with direct steering. The occupants were not familiar with the proper operation of an open bow boat and did not know the handling characteristics in rough water conditions. According to the investigating officer, the occupants had not been drinking and no alcoholic beverages were found on board.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- Inexperience on the part of the operator in this type boat is considered a major factor.
- Possible overloading. The estimated weight in the boat would indicate that the loading exceeded the maximum weight capacity (comparing this hull with similar designs tested under the Compliance Test Program at Wyle Laboratories). It is also likely that water was in the inner hull at the time of the accident, which would have increased the boat loading. This assumption is supported by the following information obtained during the investigation.
  - 1) According to the operator, the boat would not get on plane with two people aboard. If the motor was running properly, this boat/motor combination should run at a top speed of approximately 23 mph (37 kph) which would have been sufficient to get the boat on plane.
  - 2) According to Coast Guard personnel that retrieved the boat, the inner hull contained a large amount of water, and the inner hull drain plugs had to be removed to allow the water to drain. This would strongly indicate that water was in the inner hull at the time of the accident. The plugs were made of cork, and it is likely that over a period of time, water seeped around the plugs and accumulated in the inner hull.
  - 3) On the day after the accident, the outboard motor was flushed and a marina attendant test ran the boat. The boat came up on plane easily with only the attendant aboard. Observers stated that the boat performance seemed adequate to easily get on plane with two people aboard.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The following is presented, based on the narrative and knowledge of the boat characteristics.

According to the estimated weight in the boat at the time of the accident, the loading exceeded the maximum weight capacity, and there was most likely a significant amount of free water in the inner hull. The load distribution was such that the boat was most likely running essentially in a level attitude at approximately five mph (eight kph). The boat went over the crest of the two to three ft (0.6 - 0.9 m) wave and headed bow first into the trough. As the boat headed down the wave, any water in the inner hull would flow forward, increasing the weight in the bow. When the bow reached the trough, people, gear, and water weight in the bow and forward momentum of the boat caused the bow to slice into the next wave. The bow freeboard was reduced to zero and allowed water to flow freely over the bow, flooding the boat. With the flotation material installed low in the boat and the center of gravity of the weight in the boat at a much higher level, the boat had a natural tendency to capsize when flooded. After the boat was upside-down, the flotation material provided sufficient buoyancy to keep the boat afloat and stable with the occupants holding to the sides.

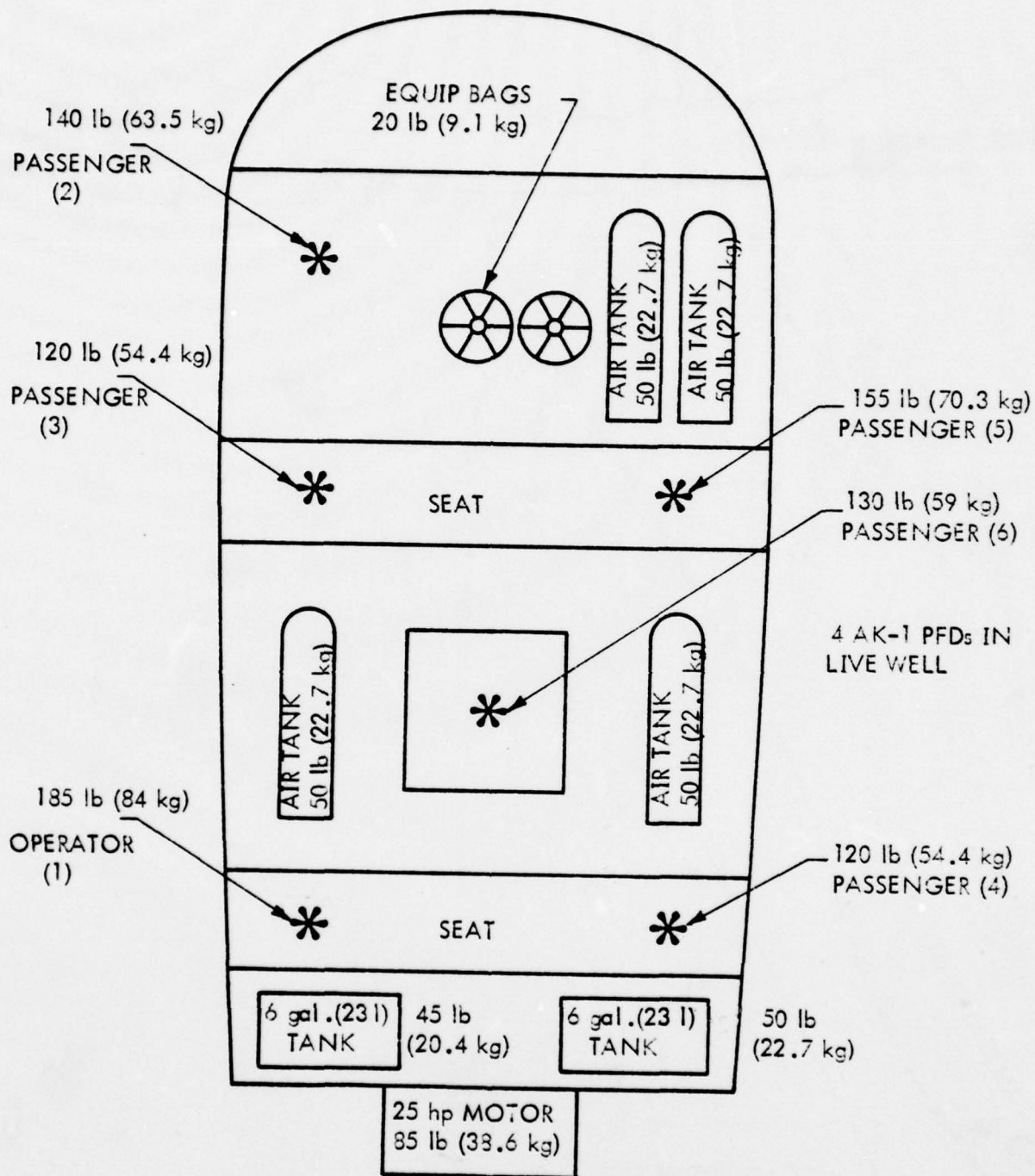


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

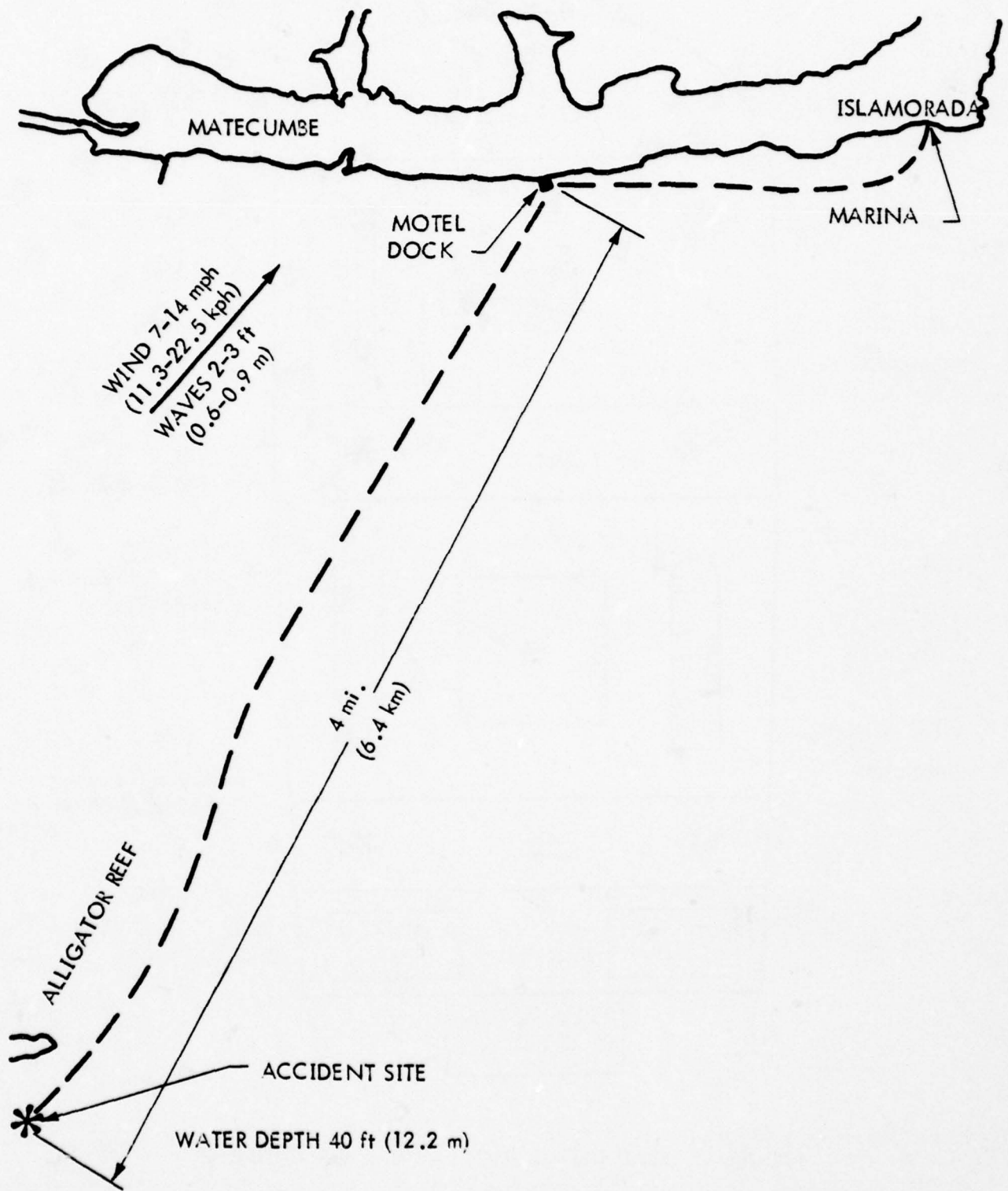


FIGURE 2. SKETCH OF ACCIDENT AREA



FIGURE 3. FRONT VIEW



FIGURE 4. SIDE VIEW

Q-11

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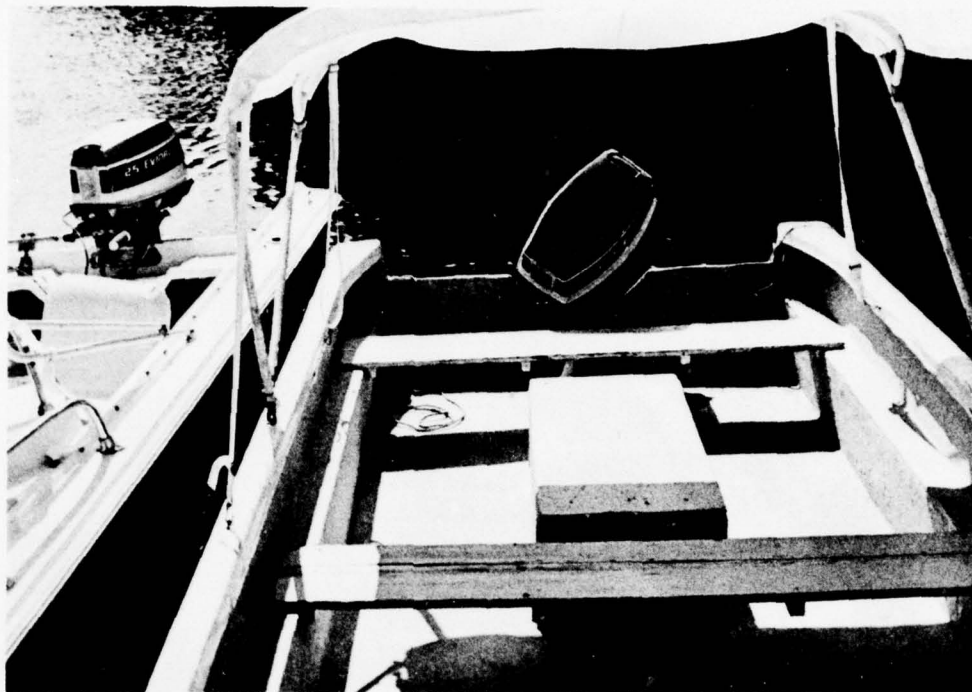


FIGURE 5. VIEW OF STERN SECTION

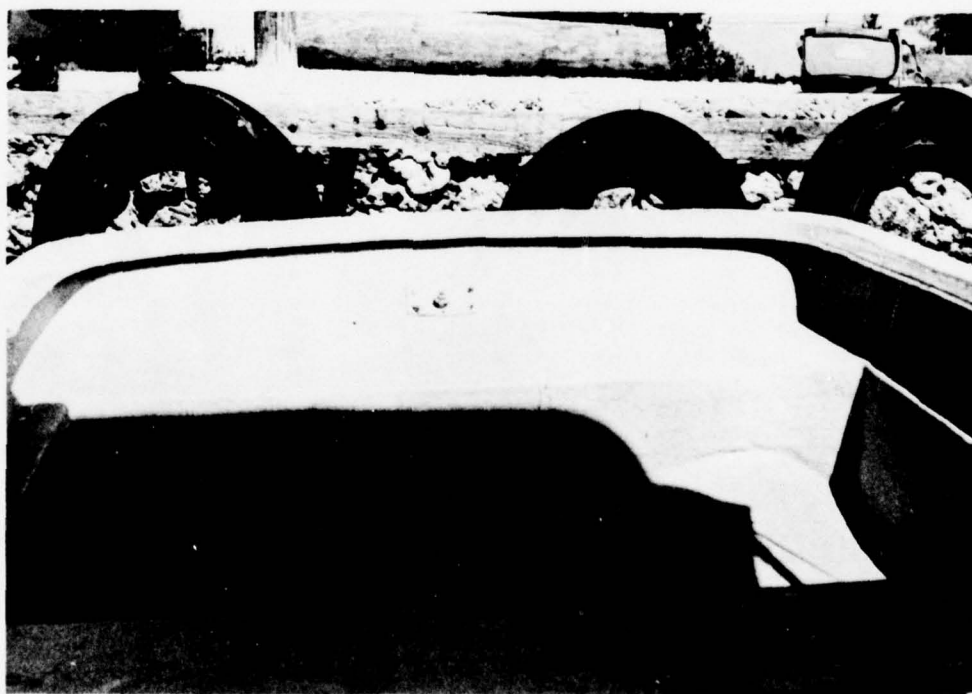


FIGURE 6. VIEW OF BOW SECTION

Q-12

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## ACCIDENT INVESTIGATION REPORT

Date of Investigation: October 28, 1976

Date of Accident: October 23, 1976

Investigation: Capsizing/Swamping No. 76-18

### SUMMARY — WYLE ACCIDENT NO. 76-613

The accident reported herein involved a 12 ft (3.7 m) aluminum johnboat powered by a seven horsepower outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1445 on October 23, 1976, two men were drifting in the involved boat about 100 yds (91.4 m) offshore in the Atlantic Ocean near Southport, N. C. The men had been troll fishing for approximately five minutes when the motor stopped. The operator was seated in the stern trying to restart the motor. The passenger was seated in the bow fishing. The passenger decided to go aft to see if he could determine what was wrong with the motor. When he reached the stern, the transom submerged and the boat flooded. As the aft section of the boat flooded, the boat rolled to starboard, dumping both men out of the boat. The boat came to rest upside-down in a near level attitude. Both men, wearing AK-1 PFDs, were rescued by a small johnboat in the area. The involved boat was towed to a small boat harbor by a Coast Guard rescue vessel.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instructions</u>	<u>PFDs Worn</u>	<u>Before</u>	<u>After</u>
Operator	M	40	200 lb (90.7 kg)	Excellent	>200 hrs	None	Yes	Yes	Yes
Passenger	M	45	195 lb (88.5 kg)	Excellent	>200 hrs	None	Yes	Yes	Yes

### 1.1 Operator

He was a high school graduate and seemed to be of average intelligence and physical ability. He had worked as a city police officer for the past fifteen years and had terminated one week before the accident with the rank of sergeant. He quit the police force to enter private business as a building contractor. He had been on fishing trips several times in the involved boat and was very familiar with the waters in the accident area. He had owned and operated small boats all his adult life.

### 1.2 Passenger

The passenger was not available for interview at the time of the investigation. According to the operator, he was a high school graduate and was of normal intelligence and physical ability. He worked as a heavy equipment operator for a construction firm. His past boating experience was similar to that of the operator.

## 2.0 ENVIRONMENT

The sky was clear and the visibility was excellent. The wind was from the northeast at seven to 10 mph (11.3 - 16.1 kph) and the water was calm. The recorded air temperature was 65°F (18°C), and the recorded water temperature was 60°F (16°C). The water depth at the accident site was approximately eight ft (2.4 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

On the day before the accident, the operator of the involved boat, his brother, and two friends planned a fishing trip for the next day. The four men met at the home of the operator's brother at approximately 0930 on October 8, 1976. The men sat around drinking beer and talking until approximately 1230. The fishing gear and boat were loaded on a pickup truck, and the men drove to a beach area approximately 10 mi. (16.1 km) away, arriving around 1250. On the way they stopped by one friend's home and put his 12 ft (3.7 m) aluminum row boat on the pickup. The fishing area was located about three mi. (4.8 km) southwest of Southport, N. C. on the Atlantic Ocean. The men fished from the beach for about 1-1/2 hrs, catching only a few fish. The operator (1) and one of the friends (Passenger (2)) decided to launch the small boat and go 100 yd (91.4 m) or so offshore to see if fishing was any better. The men launched the boat, started the motor, and went out approximately 100 yd (91.4 m). (1) was seated on the starboard side at the stern and (2) was seated in the center of the forward seat. The men started trolling parallel with the beach with (1) operating the boat and (2) troll fishing. Nearly five minutes after launching, the outboard motor stopped. (1) tried to restart the motor for approximately five minutes with no success.

#### 3.2 Accident

Gear and people aboard were as shown in Figure 1 and the weather was as noted in Section 2.0.

(1)'s brother, who was observing from the beach, called to (1) and told him the air vent on the fuel tank was closed and that was the reason the motor would not start. (1) apparently did not understand what his brother had said and continued attempting to restart the motor. (2) understood what the brother had said and started aft to open the fuel vent. (1)'s brother shouted to (2) and told him the boat would sink with both men in the stern. (2) ignored the warning and continued aft. As (2) reached the aft section, the stern freeboard decreased to zero, allowing water to flow freely over the transom into the boat. When the aft section of the boat filled with water, the boat rolled to starboard, dumping (1) and (2) out of the boat. The boat continued to roll until it was in an upside-down, near level attitude. The occupants were wearing AK-1 PFDs which supported them satisfactorily.

### 3.3 Post Accident

(1) called to his brother on shore to go call the Coast Guard to retrieve the boat. The occupants started swimming toward shore and the brother went to call the Coast Guard by telephone. The row boat had previously been taken off the pickup and placed on the beach near the water. The fourth member of the party launched the boat and rowed out to pick up the two men. When the men saw the row boat coming out, they swam back to the area where the boat capsized and began searching for the fishing gear that had fallen out of the boat. Approximately 10 min. after the capsizing, a Coast Guard rescue vessel arrived on the scene and asked the occupants if they needed any assistance. The occupants replied that they were all right but they would like to have the capsized boat towed to a nearby small boat harbor. The fishing equipment could not be located, so the two men climbed aboard the row boat and were taken ashore. The C. G. rescue vessel towed the boat to the harbor. Refer to Figure 2 for sketch of the accident area.

### 3.4 Time Sequence of Accident Events

0930-1230	Men sat around, talked, and drank beer.
1230	Left operator's brother's home for beach.
1250	Arrived at beach.
1250-1420	Men fished from beach.
1420	(1) and (2) launched boat and went out approximately 100 yd (91.4 m).
1420-1425	Passenger troll fished.
1425	Motor stopped.
1425-1430	Operator tried to restart motor.
1430	(2) went aft and boat flooded and capsized.
1432	Coast Guard called by telephone. Friend launched small rowboat to go out and pick up occupants.
1435-1445	Occupants searched for fishing gear.
1445	Coast Guard rescue vessel arrived.
1445-1455	Coast Guard towed involved boat to harbor and occupants taken ashore by rowboat.

#### 4.0 VESSEL DATA

The boat was a 12 ft (3.7 m) aluminum flatbottom johnboat manufactured by Appleby in 1969. The motor was a seven hp 1969 model Eska. The boat had styrofoam flotation material installed under all three seats. The dimensions of the material under the aft and center seats were 10 in. x 38 in. x 8 in. (0.3 x 1.0 x 0.2 m) and the measurements of the material under the forward seat were 3 in. x 8 in. x 26 in. (0.1 x 0.2 x 0.7 m). Additional data obtained during examination of the boat were as follows:

- Boat Model No. — 2CD2
- Hull Weight — 150-160 lb (68-72.6 kg)
- Max. Beam Gunwale — 46 in. (1.2 m)
- Max. Beam Chine — 32 in. (0.8 m)
- Max. Transom Width — 43 in. (1.1 m)
- Depth Amidships — 15 in. (0.4 m)
- Transom Height — 15 in. (0.4 m)
- Max. Persons Capacity — Two
- Max. Weight Capacity — 440 lb (200 kg)
- Max. Horsepower Capacity — 7.5

No evidence of damage as a result of the accident could be found. Refer to Figures 3-5 for overall boat views.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator and passenger had been out many times in the involved boat and were very familiar with its instability characteristics. The passenger knew that the boat would likely take on water with two people in the stern, but he felt he could open the fuel tank air vent and return to the bow before the boat could take on a significant amount of water.

The occupants admittedly consumed several beers before going out in the boat. Witnesses on the beach stated that the actions of the two men before and after the accident indicated that they were intoxicated. The men seemed to have very little concern for their lost fishing equipment or the condition of the boat and motor; as one witness stated, they were having a good time, laughing and splashing around in the water. They were wearing PFDs and were, therefore, not concerned about their personal safety.

## 6.0 PROBABLE CAUSE OF ACCIDENT

Alcohol is considered the major contributing factor in this accident. The passenger knew that his decision to go to the stern could cause the boat to swamp and an observer on shore warned him that the boat would flood with two people in the stern. He was most likely intoxicated to the level that made him unconcerned of the possible consequences of his actions.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

According to the estimated weight in the boat at the time of the accident, the boat was loaded to near the maximum weight capacity. When the passenger moved to the stern, the weight of the two occupants reduced the transom freeboard to zero, allowing water to flow freely over the transom into the boat. The center of gravity of the occupants was much higher than the flotation material, which caused the boat to have a natural tendency to capsize when flooded. The location of the flotation material caused the boat to float in a stable, near level attitude once it was upside-down.

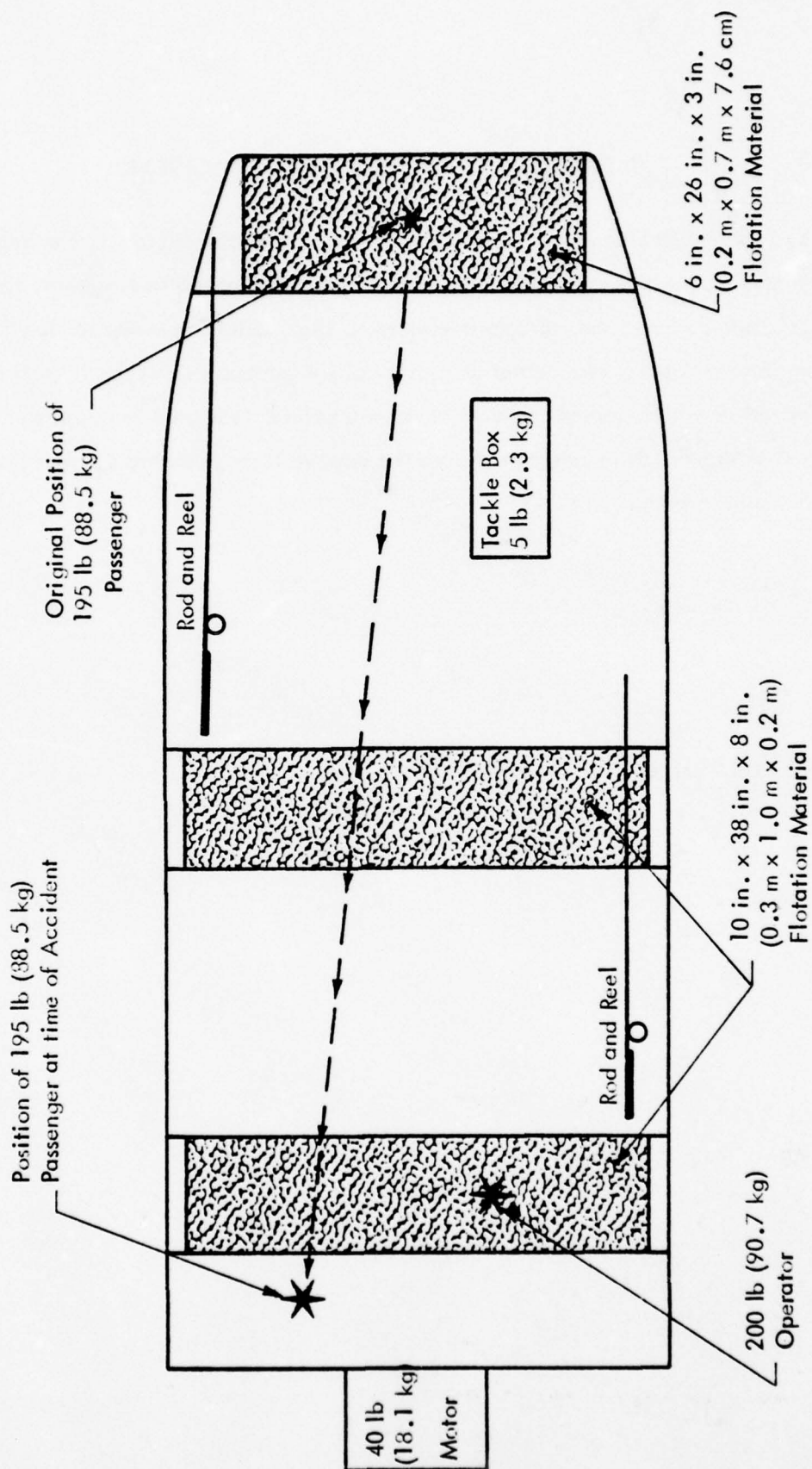


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

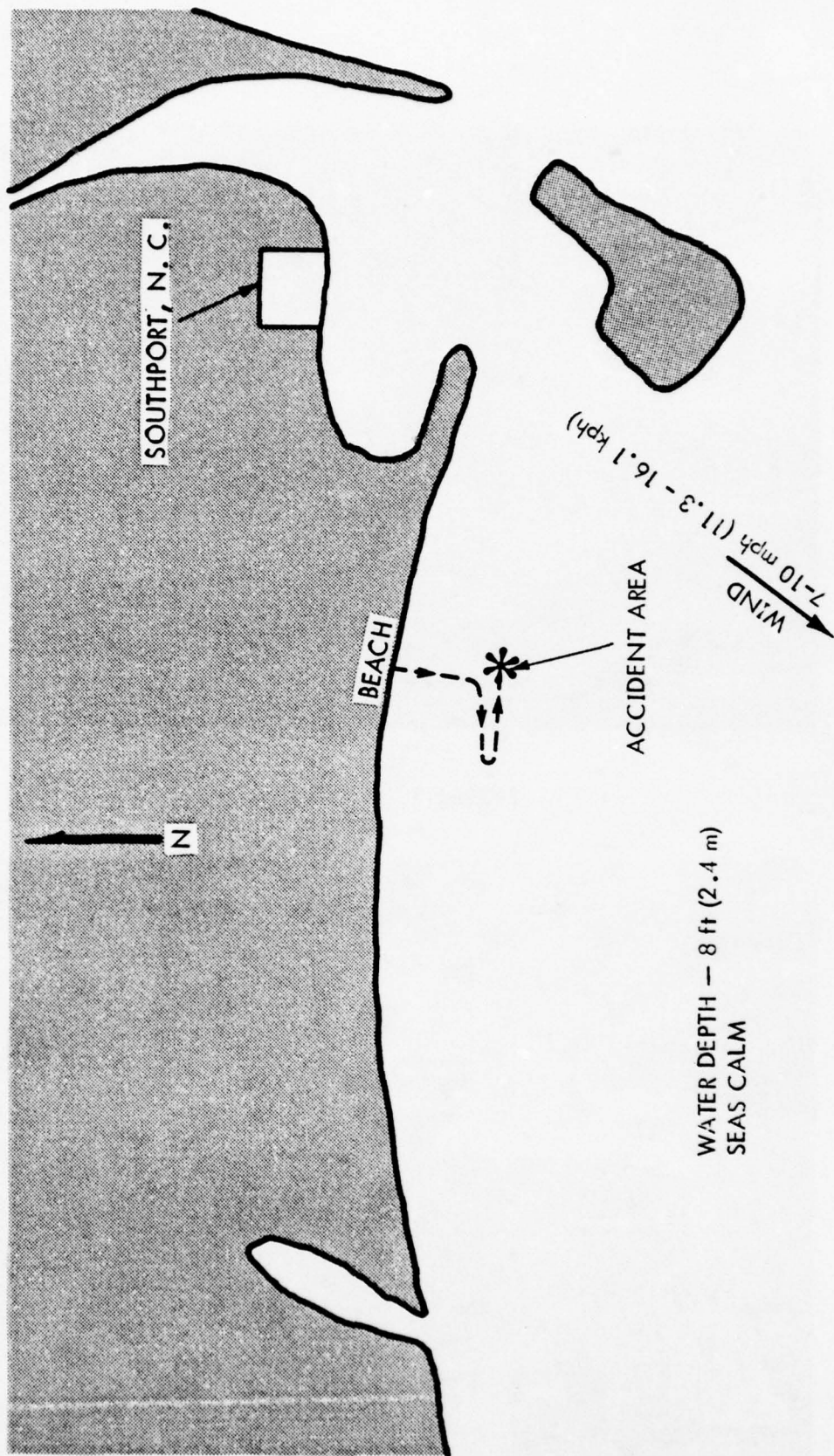


FIGURE 2. SKETCH OF ACCIDENT AREA

R-9



FIGURE 3. BOW VIEW



FIGURE 4. STERN VIEW

R-10

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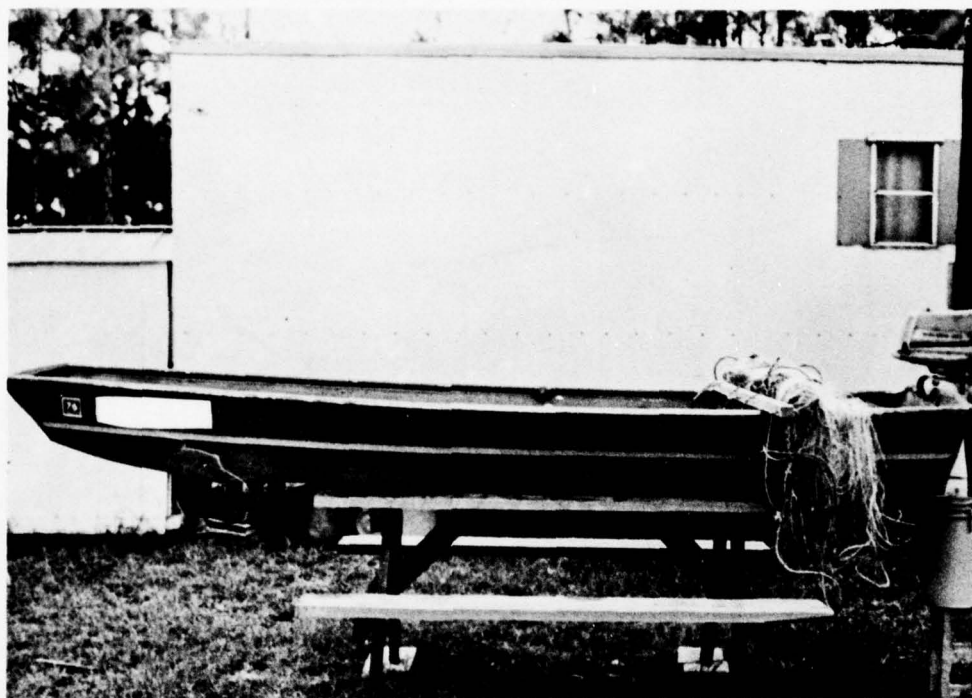


FIGURE 5. SIDE VIEW

R-11/12

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274X

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: October 29, 1976

Date of Accident: October 24, 1976

Investigation: Capsizing/Swamping No. 76-19

### SUMMARY — WYLE ACCIDENT NO. 76-614

The accident reported herein involved a 13-1/2 ft (4.1 m) fiberglass tri-hull bass boat powered by a 50 horsepower outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1430 on October 24, 1976, two men were returning from a fishing trip along the Atlantic Coast near Swansboro, N. C. The boat had entered Bear Inlet approximately three mi. (4.8 km) south of Swansboro and was traveling over a shallow area in three to four ft (0.9 - 1.2 m) whitecaps. The boat went over a wave, into the trough where the propeller and motor skeg hit the bottom, causing the motor to stop. The skeg began to hit bottom when the stern of the boat went into the wave troughs. The operator grabbed the boat paddle and started pushing the boat in a pole maneuvering fashion toward the center of the inlet where the water was deeper. After pushing the boat approximately 25 ft (7.6 m), the water became deep enough to start the motor. Before the restart was accomplished, three successive waves came over the bow, partially swamping the passenger compartment. The boat then turned broadside to the waves and within a few seconds was taking waves over the port side. The

boat rapidly flooded and began to roll to port. The occupants grabbed AK-1 PFDs and jumped out of the boat over the port side. The boat continued to roll until it was upside-down in a bow high attitude. The occupants donned their PFDs and stayed with the boat for about 20 min. until rescued by a small boat that was in the area. The boat was recovered by a Coast Guard rescue vessel.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instructions</u>	<u>PFDs Worn</u>	
							<u>Before</u>	<u>After</u>
Operator	M	27	160 lb (72.6 kg)	Good	>500 hrs	None	No	Yes
Passenger	M	22	170 lb (77.1 kg)	Good	>200 hrs	None	No	Yes

The owner/operator and passenger were high school graduates and worked as mechanics for a used car dealer. They were of average intelligence and physical ability and possessed at least an average knowledge of small boat operations. They had each owned and operated small boats for the past seven years. They went fishing together almost every weekend and were very familiar with the waters in the accident area. The majority of their boating experience had been in coastal waters in the vicinity of Swansboro, N. C.

## 2.0 ENVIRONMENT

The sky was clear and the visibility was excellent. The wind was from the northeast at seven to 10 mph (11.3 - 16.1 kph) and the water conditions were one to two ft (0.3-0.6 m) rolling swells in the ocean and three to four ft (0.9-1.2 m) white caps in the inlet. The recorded air temperature was 67°F (19°C) and the recorded water temperature was 60°F (16°C). The water depth at the accident location ranged from three to eight ft (0.9 - 2.4 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

During the week preceding the accident, the owner/operator of the involved boat (1) and a co-worker (Passenger (2)) made plans to go on a fishing trip on Sunday, October 8, 1976. The night before the accident, the two men worked on their fishing gear and went to bed about 2300. (1) got up around 0630, hooked his boat and trailer to his pickup truck, and drove to (2)'s house approximately three mi. (4.8 km) away, arriving at 0650. The boat was launched at (2)'s private ramp and the fishing gear was loaded aboard. The men got underway from the ramp around 0700 destined for Bogue Inlet approximately 3-1/2 mi. (5.6 km) away. The men traveled out Bear Inlet, up the Coast, and arrived at Bogue Inlet around 0715. The men troll fished in the inlet until nearly 1420. At this time they had caught all the fish they wanted and decided to go back to (2)'s ramp. They traveled back down the coast, arriving at Bear Inlet at approximately 1430. (1) decided to take a short cut across a shallow area to the inside of the inlet. After traveling a short distance, the boat rode up over a wave and into the trough. When the stern went into the trough, the propeller and skeg hit the bottom, causing the motor to stall. The boat started drifting toward the center of the inlet with the motor skeg hitting bottom when the stern went into a trough. (1) realized he could not restart the motor until the boat was in deeper water. He grabbed the paddle and used it as a pole to push the boat to the center of the inlet and deeper water. After maneuvering the boat a short distance, the skeg was only occasionally hitting the bottom and (1) decided to restart the motor. Before he could accomplish the restart, the bow of the boat turned into the wind and waves, and three successive waves broke over the bow into the boat, partially flooding the passenger compartment.

#### 3.2 Accident

Gear and people aboard were as shown in Figure 1 and the weather was as noted in Section 2.0.

The boat then turned broadside to the waves and almost immediately took a wave over the port side, filling the boat approximately 1/2 full of water. (1) grabbed two AK-1 PFDs that were floating in the stern section and threw one to (2) who was seated in the bow. The men immediately donned the PFDs. By this time the motor had been flooded with water and would not

start. The next wave to hit broadside completely swamped the boat and caused it to start a roll to port. The men realized the boat was capsizing and jumped out over the port side. The boat continued to roll until it was in an upside-down, bow high attitude.

### 3.3 Post Accident

After the boat capsized, the men swam to the front of the boat and held to the bow. The men could see two small boats near the south side of the inlet approximately 500 yd (457 m) away. They waved and shouted for approximately 10 minutes but were unable to attract the attention of the occupants in the other boats. (1) removed his PFD and waved it for a short time until the occupants of one of the boats saw his signal. When the boat started toward him, he put his PFD back on. The boat arrived, took (1) and (2) aboard, and transported them to (2)'s ramp. When the boat capsized, the anchor, with the line tied to the bow, fell out and held the boat in the accident area. After reaching shore, (1) called the Swansboro Coast Guard who dispatched a rescue vessel to retrieve the capsized boat. When the rescue vessel arrived at the accident area, the anchor line had broken and the involved boat had drifted nearly one mi. (1.6 km) from the accident area. The rescue vessel located the boat and towed it to the Swansboro municipal docks. Refer to Figure 2 for sketch of accident area.

### 3.4 Time Sequence of Accident Events

0630	Operator arose to prepare for fishing trip.
0650	Operator arrived at passenger's home.
0700	Men left passenger's ramp.
0715	Arrived at Bogue Inlet.
0715-1420	Troll fished in Bogue Inlet area.
1420	Departed inlet for ramp.
1430.	Arrived at Bear Inlet.
1431	Prop hit bottom, stopping motor.
1431-1435	Maneuvered boat to deeper water.
1435	Waves came over bow, partially swamping boat.
1435-1436	Wave broke over port side, filling boat 1/2 full of water.

1436-1437	Occupants donned PFDs.
1437-1438	Second wave broke over port side, completely swamping and capsizing boat.
1438-1439	Occupants swam to front of boat and held to bow.
1439-1449	Occupants attempted to attract attention of other boats.
1455	Occupants taken aboard small boat and transported ashore.
1505	Swansboro Coast Guard called. C. G. rescue vessel dispatched to accident scene.

#### 4.0 VESSEL DATA

The boat was a 13-1/2 ft (4.1 m) tri-hull fiberglass bass boat manufactured by Ebbtide in 1974. The motor was a 50 hp 1974 model Evinrude. Additional data obtained during examination of the boat were as follows:

- HIN — ETC 282550274
- Max. Beam Gunwale — 66-1/2 in. (1.7 m)
- Max. Beam Chine — 56-1/2 in. (1.4 m)
- Max. Transom Width — 66 in. (1.7 m)
- Depth Amidships — 17 in. (0.4 m)
- Transom Height — 20 in. (0.5 m)
- Estimated Hull Weight — 500 lb (226.8 kg)
- Max. Persons Capacity — 555 lb (251.7 kg)
- Max. Weight Capacity — 940 lb (426.4 kg)
- Max. hp Capacity — 60

The boat hull received only minor gelcoat damage as a result of the accident. Boat components which were ripped out and lost included the windshield, forward seat, and a cooler that had been attached to the deck in front of the steering console. Also, the stern light mast had been broken off. Refer to Figures 3-6 for overall boat views.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The occupants stated that they had been through Bear Inlet many times in the involved boat when the water conditions were as rough as on the day of the accident. They stated that they had taken on water before but not enough to significantly reduce the freeboard. Also, they had never run aground in the inlet before the day of the accident. It is very possible that the boat would have made it through the inlet had it not run aground. However, this type boat was definitely not designed to be operated in the water conditions that existed at the time of the accident. Therefore, it is apparent that the occupants were overconfident in their equipment.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident.

- Operating this type boat in three to four ft (0.9 - 1.2 m) breaking waves is considered the major contributing factor.
- Loss of the motor resulting in loss of directional control is considered a significant factor.
- The operator exercised poor judgment in his decision to cut across the shallow portion of the inlet.
- Overconfidence in equipment certainly resulted in creating the accident situation.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

According to the estimated weight in the boat at the time of the accident, the boat was not overloaded. When the motor skeg started dragging on the bottom, it is assumed that the outgoing tide caused the boat to pivot about the skeg until the bow was into the wind and waves. The open design of the boat allowed any water coming over the bow to go directly into the passenger compartment. Partial swamping of the boat over the bow caused the free-board to be reduced significantly. Wave action most likely caused the boat to turn broadside to the waves. Waves over the side completely swamped the boat and, because all the flotation material was installed below deck level, the boat had a natural tendency to capsize when flooded. The motor weight caused the boat to float bow high after capsizing.

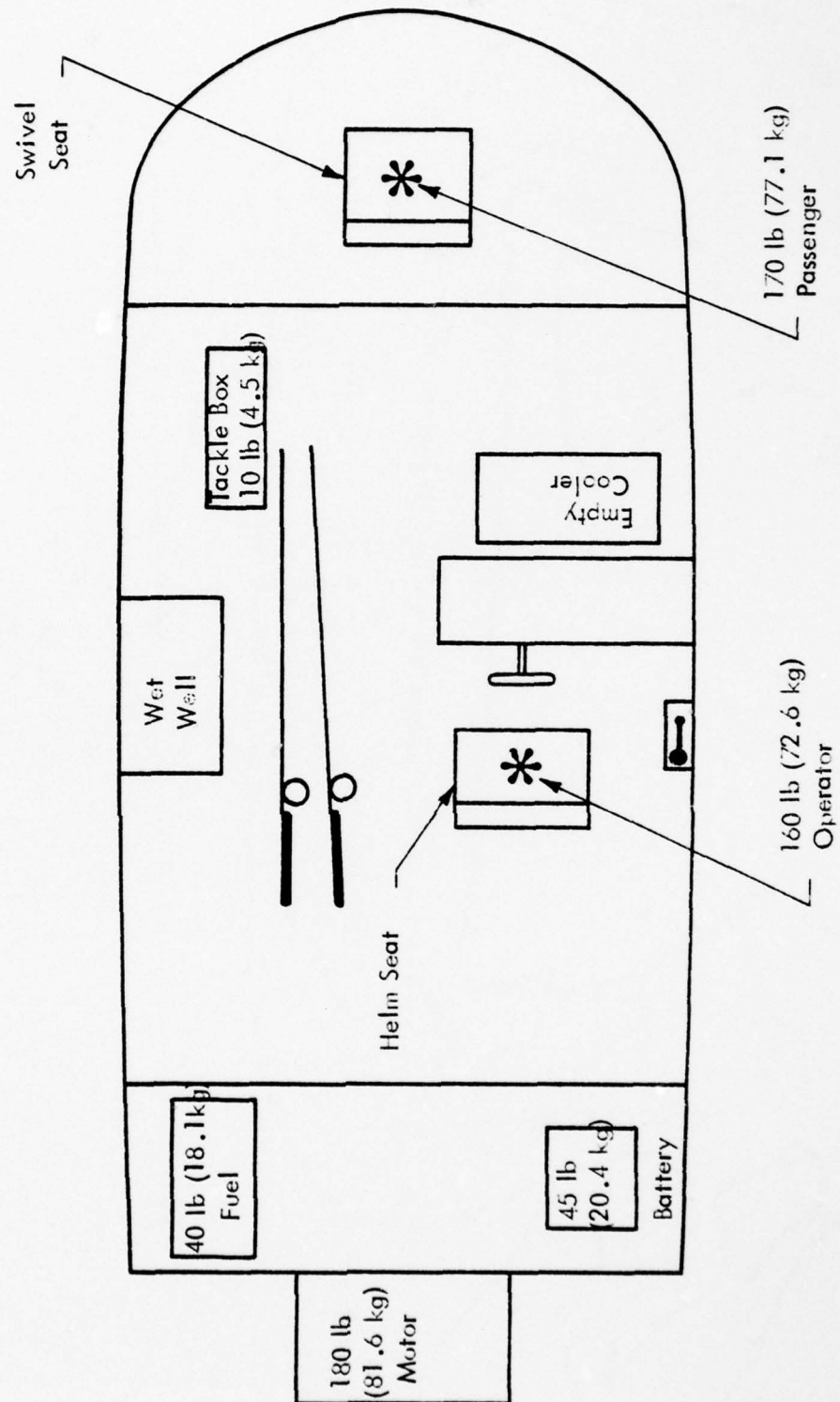


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

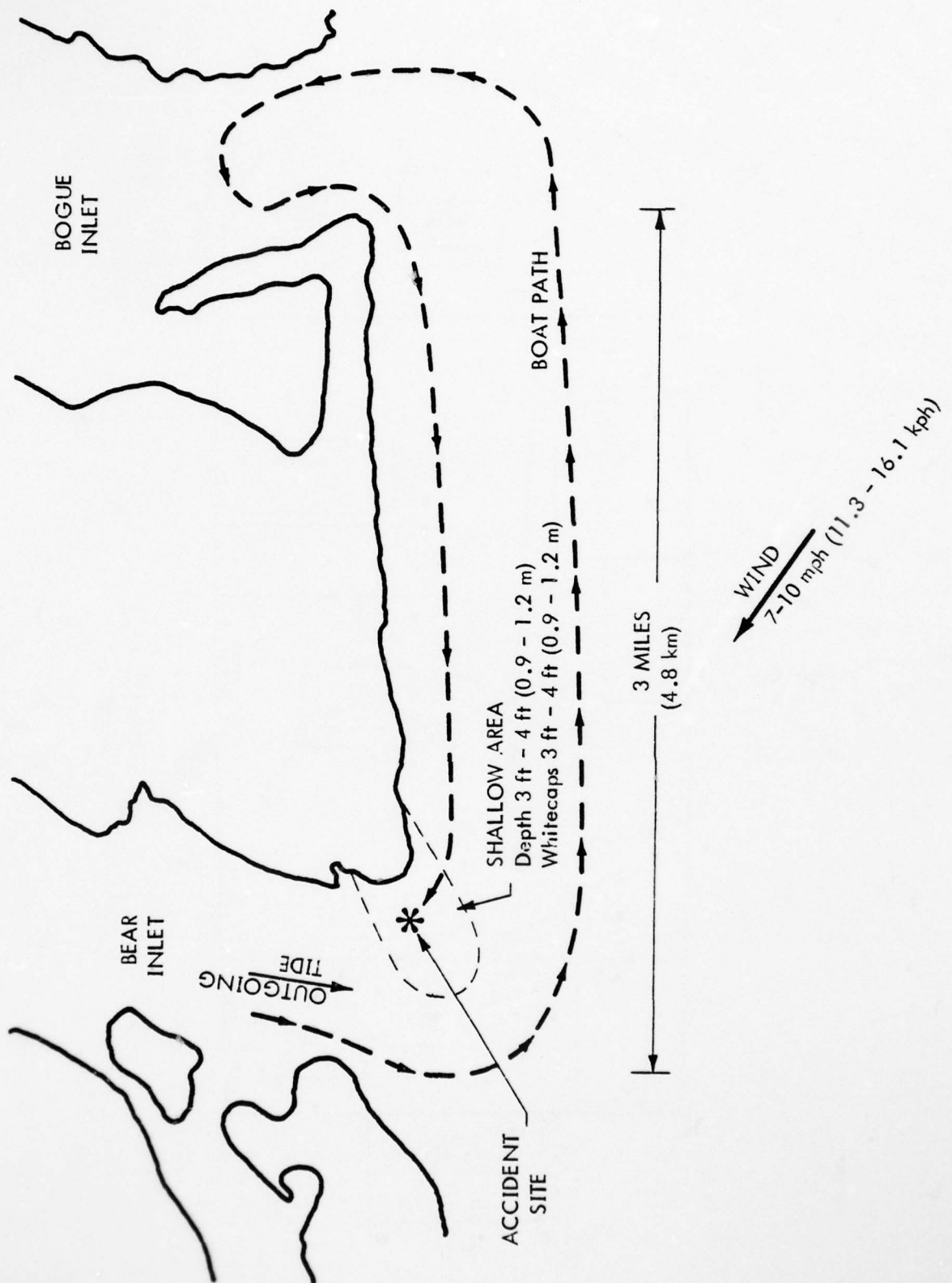


FIGURE 2. SKETCH OF ACCIDENT AREA

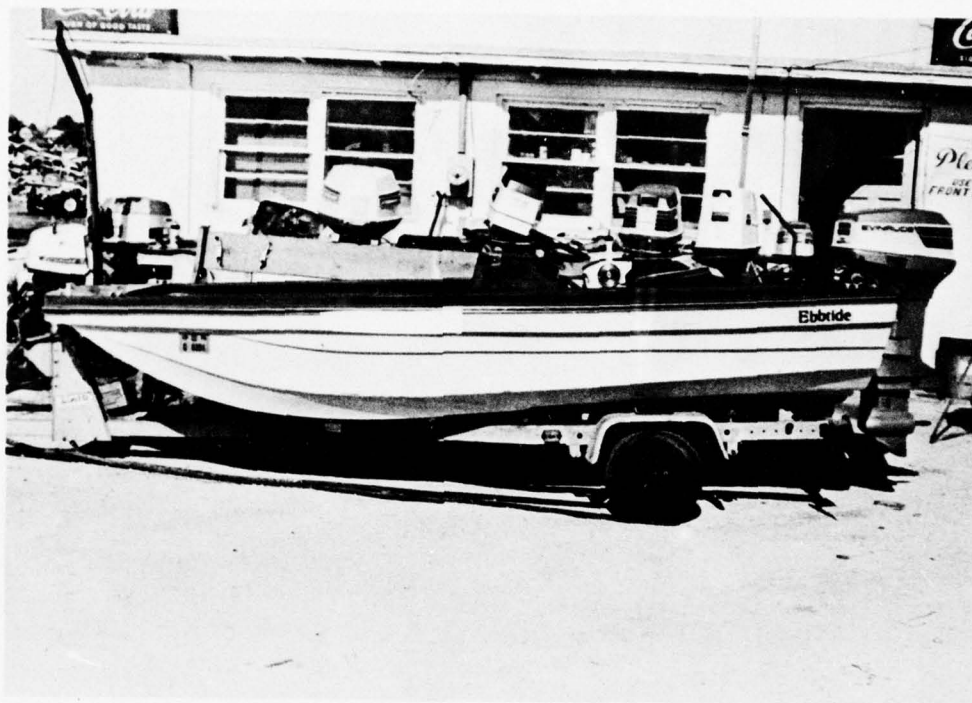


FIGURE 3. SIDE VIEW

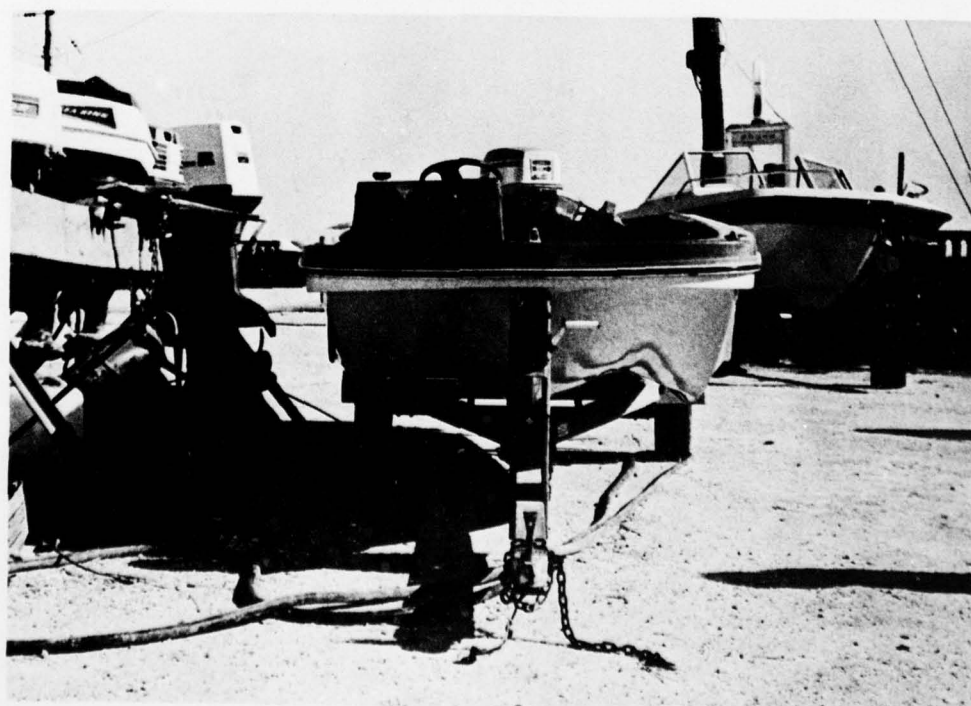


FIGURE 4. BOW VIEW

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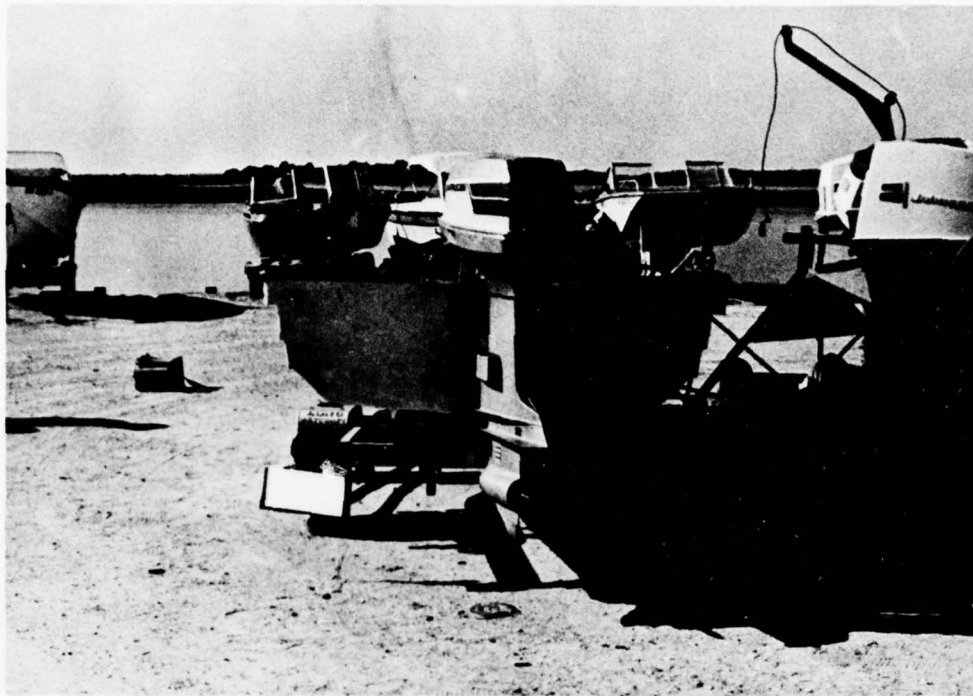


FIGURE 5. STERN VIEW

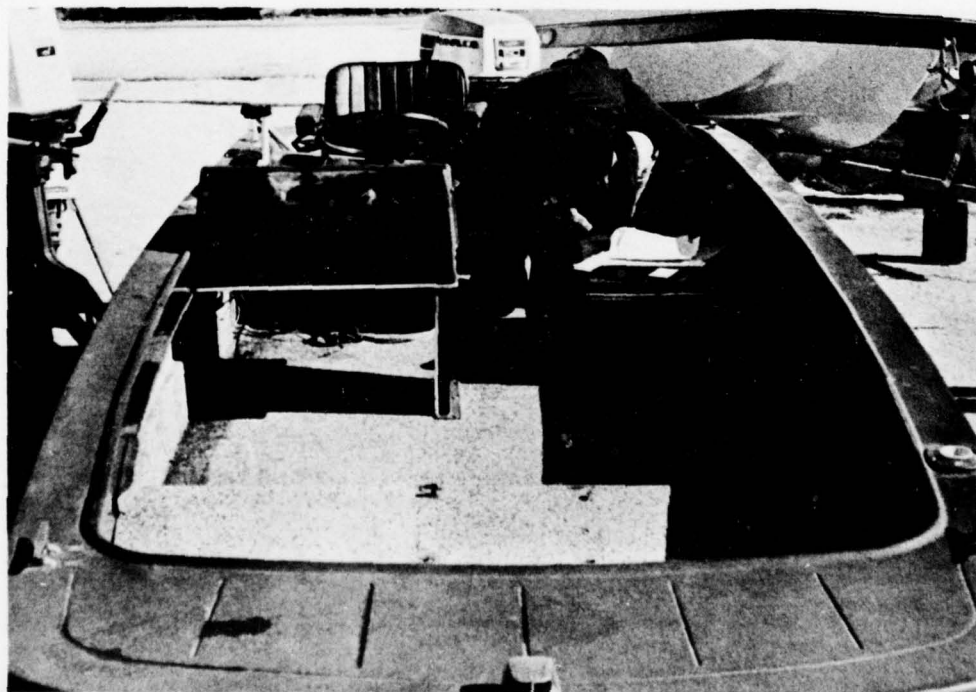


FIGURE 6. INTERIOR VIEW

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: November 11, 1976

Date of Accident: October 11, 1976

Investigation: Capsizing/Swamping No. 76-20

### SUMMARY — WYLE ACCIDENT NO. 76-587

On the morning of October 11, 1976, two men left on a fishing trip in an 18 ft (5.5 m) out-board boat. They cruised for about an hour and a half to a bait shop near the place they had planned to fish. They bought bait and refilled the fuel tank and then proceeded to the fishing area. There was a slight chop of less than 6 in. (15.2 cm) height at this time. As they were proceeding toward the fishing area, a large "freak" wave broke over the bow of the boat, filling the boat with a considerable amount of water and causing the engine to stall. Both occupants moved to the port side to get PFDs from under the port seat. Before they could don them, the boat heeled to port and then capsized. They held onto the PFDs in the water until a nearby boat rescued them after about 10 min. The rescue boat took them to a nearby hospital where they were examined and released. The boat was not recovered and apparently drifted out to sea.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn/Used</u>	
							<u>Before</u>	<u>After</u>
Operator	M	40	175 lb (79.4 kg)	Fair	<100 hr	None	No	Yes
Passenger	M	34	135 lb (61.2 kg)	Poor	<100 hr	None	No	Yes

The operator and the passenger were co-owners of the involved boat. They bought it new in 1974. Previous to this they had owned a 10 yr old 18 ft (5.5 m) wooden outboard boat for about four months. This wooden boat was the first boat that either of the occupants had operated.

## 2.0 ENVIRONMENT

The passenger generally obtained weather forecasts from the weather station broadcast. Seas were fairly calm with about six in. (15.2 cm) waves at the beginning of the trip. Sea conditions improved as the trip progressed to near calm. Wind was light to moderate with air temperature at 52°F (11°C).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

The following narrative was formulated from an interview with the passenger and co-owner of the boat.

#### 3.1 Pre-Accident

The boat was kept at a marina in Sag Harbor on Long Island (Figure 1). The two occupants drove from the home of the passenger in Queens to the boat the morning of the accident. It was approximately a two hour drive, and they reached the marina about daybreak. The fuel tank had been filled after the last outing, and the only gear that was loaded on board was fishing gear consisting of two fishing poles and two tackle boxes. Loading at the beginning of the trip, which was the same as at the time of the accident, was as shown in Figure 2.

They left the dock and proceeded toward Montauk Point at cruise speed, arriving at Montauk Point in about an hour and a half. They stopped at a fishing supply station near the point, bought bait, and refilled the fuel tank.

#### 3.2 Accident

They left the bait shop and proceeded toward their intended fishing area which was just off Montauk Point. The seas were calm at this time except for one freak wave which broke over the bow of the boat, filling it with a considerable amount of water. The engine stalled and the occupants, realizing that the boat had a large quantity of water in it, decided to don PFDs. They both went to the port side of the boat to get the PFDs from under the port seat. They did not have time to don the PFDs as the boat heeled and began to capsize due to their combined weight on the same side of the boat. They jumped from the boat as it capsized and assumed an inverted, level attitude.

### 3.3 Post Accident

When the passenger first noticed the boat after it capsized, it was approximately 20 ft (6.1 m) away. He felt that the boat was too far away to swim to and decided not to try. He tried to don his PFD but could not. He held onto the PFD with the two ends, one under each arm and the center part across his chest. The operator's PFD had torn apart and he held onto a part of it. The operator and passenger were about 25 ft (7.6 m) apart in the water.

Another boat in the area saw the sea gulls circling over the victims in the water and decided to investigate. As they came near, they saw the two people in the water and rescued them. The occupants of the accident boat had been in the water for 5 to 10 min. before being rescued. The rescue boat took them to Southampton where they had called ahead to have an ambulance waiting. It took approximately 20 min. to get to the hospital from the time of rescue. They were given coffee to drink. The two victims spent approximately two hours at the hospital being examined and having chest x-rays taken. They were then taken to their car at Sag Harbor. The rescue boat had notified the Coast Guard as they were rescuing the victims. The Coast Guard searched the area for the boat but they did not find it.

### 3.4 Time Sequence of Accident Events

0500	Left home and drove to the marina where the boat was kept.
0700	Arrived at the boat at Sag Harbor.
0710	Left Sag Harbor.
0840	Arrived at bait shop, bought bait and fuel.
0850	Left bait shop.
0900	Wave came over bow.
0901	Took PFDs from under seat.
0901-1/2	Boat capsized.
0902	Held onto PFDs while in water.
0912	Rescue boat picked up occupants.
0930	Arrived at hospital for checkup.
1130	Left hospital for their car at Sag Harbor.

#### 4.0 VESSEL DATA

The co-owner of the boat said that he thought the boat was an 18 ft (5.5 m) 1974 model year Boston Whaler and that the model name was Sport Craft Tri-Hull. Boston Whaler did not make an 18 ft (5.5 m) boat or one with that model name. The operator described the boat as having a walk-through windshield and back-to-back seats both port and starboard. No Boston Whaler literature contained any such configuration. Sport Craft Inc. did not make an 18 ft (5.5 m) boat that fit the description given by the co-owner. The registration papers of the boat were not available for inspection.

Based on the information given by the co-owner of the boat, the following description is given:

Model Year: 1974

Bow Type: Open

Length: 18 ft (5.5 m)

Material: Fiberglass

Hull Type: Tri-Hull

HP on Board: 1974 model 50 hp Evinrude

#### 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The occupants of the boat were quite familiar with the area in which the accident happened. They had observed "freak" waves in this area on many occasions. On the other occasions, however, the seas were fairly rough and they had associated these "freak" waves with rougher seas than were present at the time of the accident. If the operator had been more attentive in expecting this type of wave, he may have been able to take evasive action to prevent the wave from breaking over the bow of the boat. The passenger said that when he first started boating, he would wear a PFD at all times. As he became more confident in boating, he stopped wearing a PFD. His swimming ability had not changed and was still poor, but he was confident that he would not get into trouble after boating for a relatively short period of time.

## 6.0 PROBABLE CAUSE OF ACCIDENT

Operating an open bow boat in unprotected waters that are known to have large waves was the major cause of this accident. Inattention on the part of the operator may also have contributed to the accident in allowing a wave to come directly over the bow.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

A large wave broke over the bow of an open bow boat. This wave filled the boat with a considerable amount of water and caused the engine to stall. The two occupants moved to the port side of the boat to get PFDs out from the seat where they were stored. Their combined weight plus the free surface effect of the water in the boat caused a heeling moment of sufficient magnitude to capsize the boat. The occupants jumped from the boat as it capsized and assumed an inverted, level attitude.

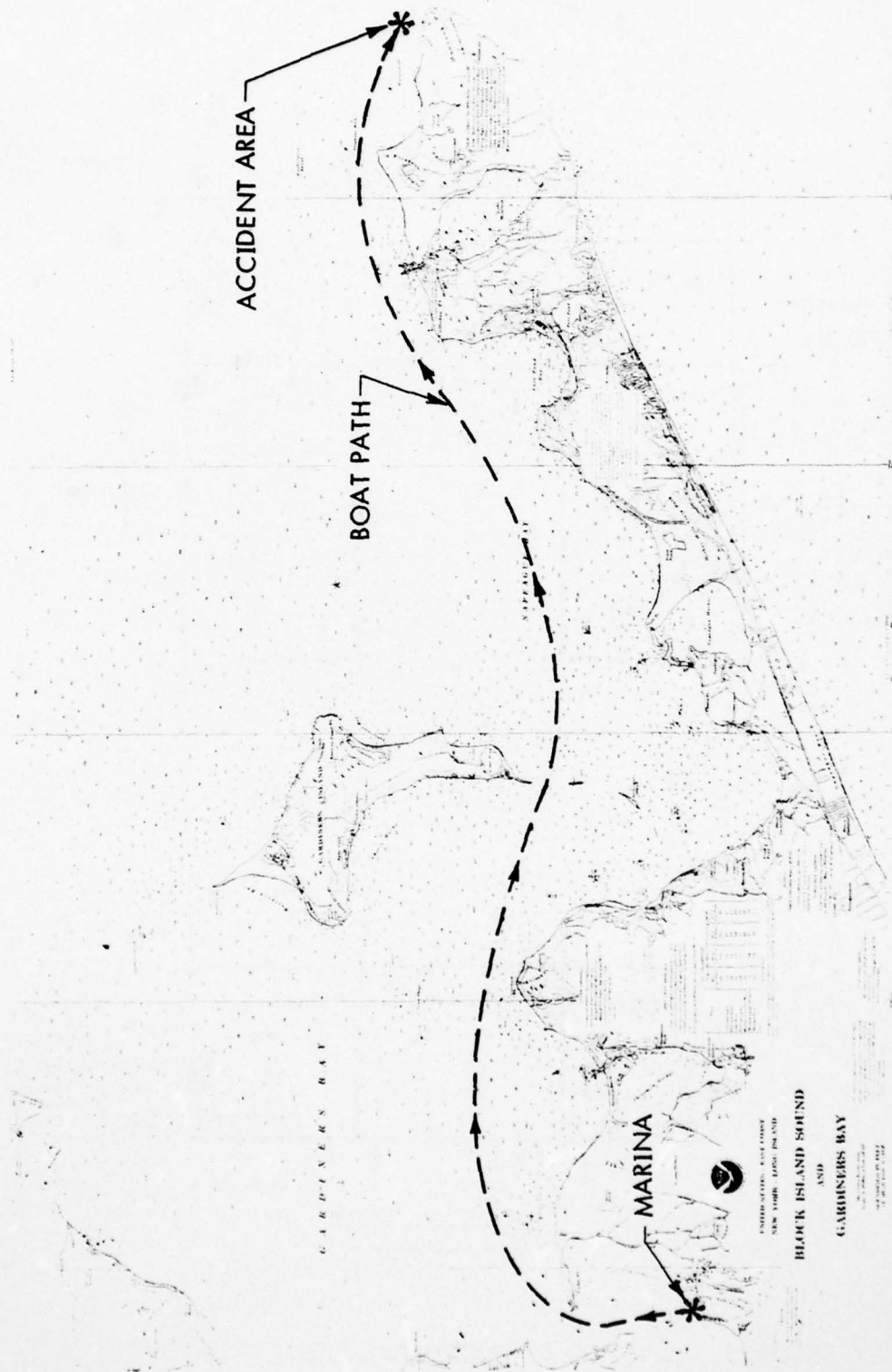


FIGURE 1. ACCIDENT AREA

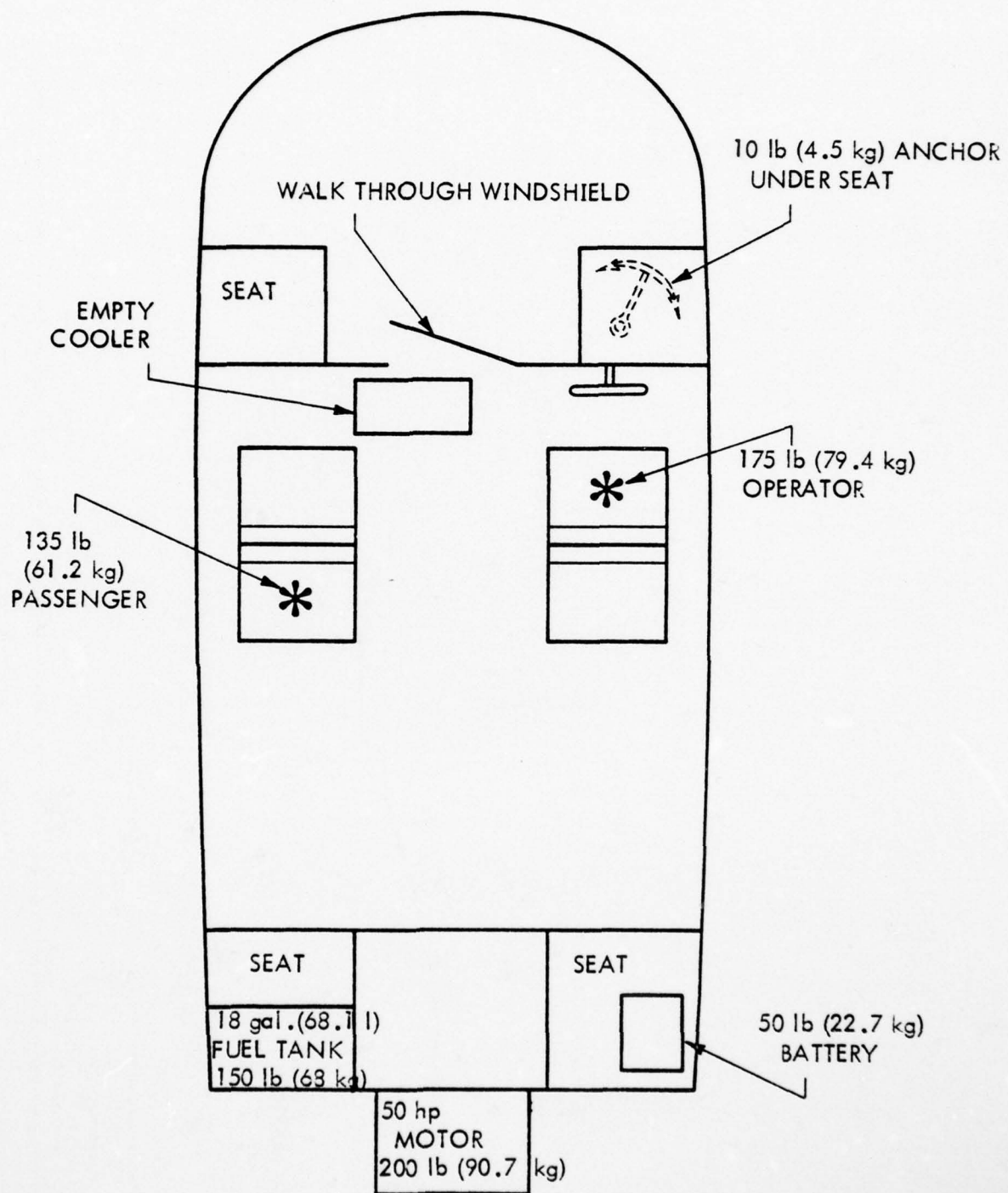


FIGURE 2. LOADING DISTRIBUTION AT TIME OF ACCIDENT

# ACCIDENT INVESTIGATION REPORT

Date of Investigation: January 7, 1977

Date of Accident: October 9, 1976

Investigation: Capsizing/Swamping No. 76-21

## SUMMARY — WYLE ACCIDENT NO. 76-590

The accident reported herein involved a 16'9" (5.1 m) fiberglass tri-hull runabout powered by a 85 hp outboard motor. The type of accident was a swamping, resulting in no injuries or fatalities.

At approximately 0800 on October 9, 1976 the involved boat was anchored near Morehead City Channel No. 20 approximately 100 yd (91.4 m) from the Fort Macon, N.C., Coast Guard station. The operator/owner (sole occupant of the boat) had been fishing in that location for approximately seven hours. Within a period of five minutes, a thunderstorm moved into the area decreasing the visibility to near zero and causing the water conditions to change from a light chop to 4-5 ft (1.2-1.5 m) whitecaps. Rain and breaking waves completely swamped the boat before the operator could get underway to safety. The operator stayed in the swamped boat until the storm passed (approximately ten minutes) and he was rescued by a Coast Guard vessel.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn/Used</u>	
							<u>Before</u>	<u>After</u>
Operator	M	45	200 lb (91 kg)	Excellent	75-100 hr	None	No	No

The owner/operator was a high school graduate and seemed to be of average intelligence and physical ability. He had owned only one boat (involved boat) and all of his operating experience had been gained in this boat. He usually went out alone and had learned to operate the boat by reading manufacturer's literature and by trial and error. Most of his operating time had been in the area where the accident occurred.

## 2.0 ENVIRONMENT

Prior to the thunderstorm, the sky was partly cloudy and the visibility was restricted only by darkness. The wind was from the northeast at 7-14 mph (11.3-22.5 kph) and there were light chops on the water. At the time of the accident the wind was from the southwest at 25-50 mph (40.2-80.5 kph), there were 5-6 ft (1.5-1.8 m) whitecaps, heavy rain and the visibility was near zero. The recorded air and water temperature was 65°F (18.3°C). The water depth in the accident area ranged from 15-20 ft (4.6-6.1 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

The owner/operator had purchased the involved boat in April, 1975. Since that time he had spent almost every nice weekend fishing in the waters near Morehead City, N.C. During the week preceding the accident he had made plans to return to that area for a fishing trip on Saturday, October 9. After getting off work on Friday, October 8, he connected the boat/trailer to his pickup truck and departed his home for the fishing area at approximately 1830. He arrived at the launch area approximately 200 miles (321.8 km) away at 0100. He launched the boat, loaded the fishing gear aboard and departed for a fishing area approximately two miles (3.2 km) away. It was dark and he had to follow lighted channel markers to find his way to the area. He arrived at the fishing spot at approximately 0110, anchored the boat by the bow, and began fishing. During the early hours of the morning he saw several thunderstorms move through the area, but none in his immediate vicinity. Two of the thunderstorms came close enough that he could feel the wind generated by them. At approximately 0755, he noticed the wind direction had changed from the northeast to the southwest and the velocity was rapidly increasing. Within two minutes the velocity was over 25 mph (40.23 kph) and swells were beginning to build. He could then see a thunderstorm was approaching and decided to go to the shelter of the Coast Guard station. He stowed his fishing gear and went to the helm to start the motor. At this point, the full force of the storm hit with heavy rain, strong wind (25-50 mph (40.23-80.5 kph) and whitecaps 4-5 ft (1.22-1.52 m) high. The rain and water spray reduced visibility to near zero. He could not see the anchor line and decided he had better pull in the anchor before starting the motor because the line could get caught in the prop. As he went to the bow, he could feel the anchor break loose from the bottom and the boat start to drift. He pulled in the anchor, returned to the helm, and attempted to start the motor.

#### 3.2 Accident

The location of the operator and gear was as shown in Figure 1 and the weather was as noted in Section 2.0. The motor had been saturated with water and would not start. The boat

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CAPSIZING/SWAMPING ACCIDENT INVESTIGATIONS FOR 1976 SEASON. (U)  
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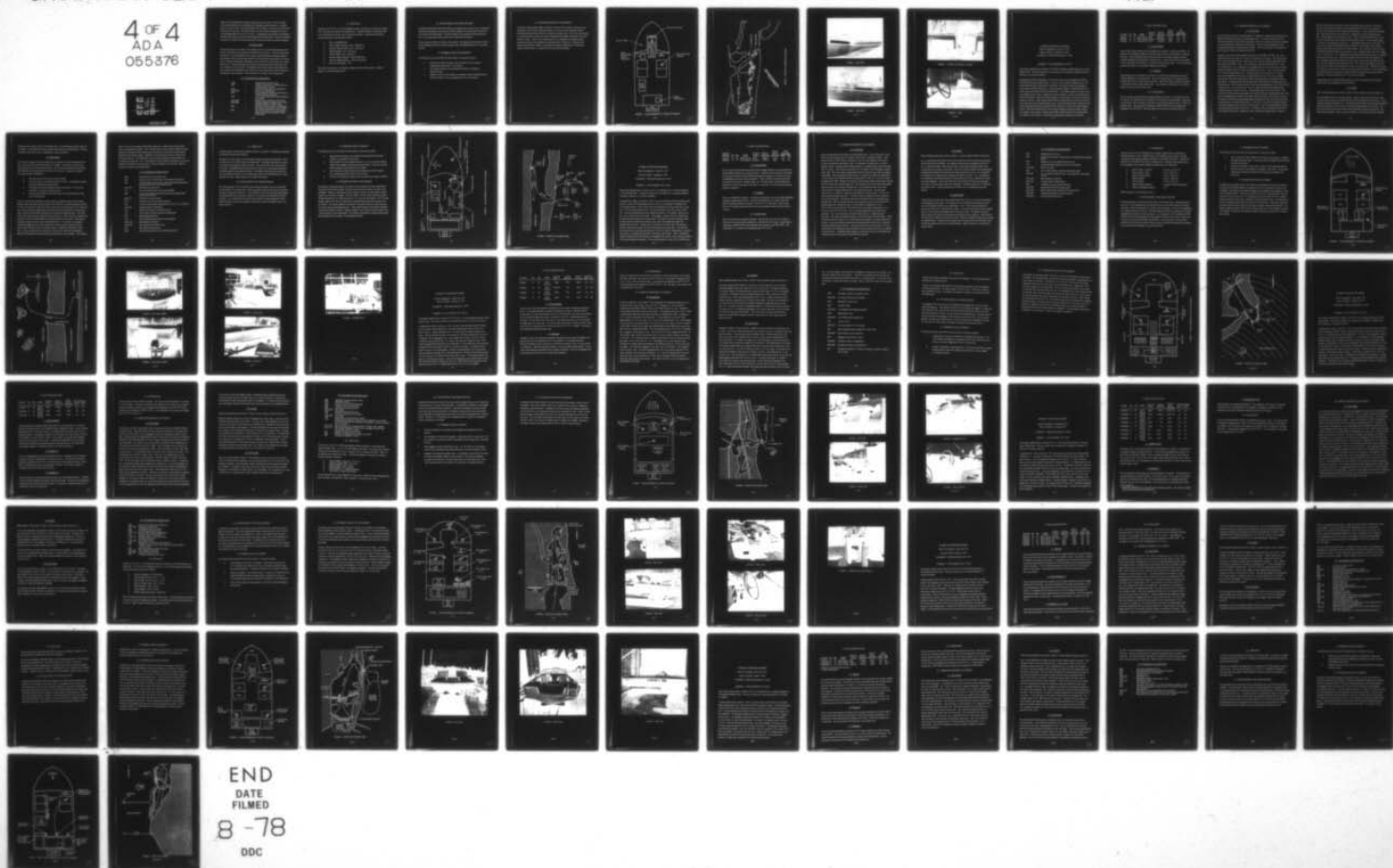
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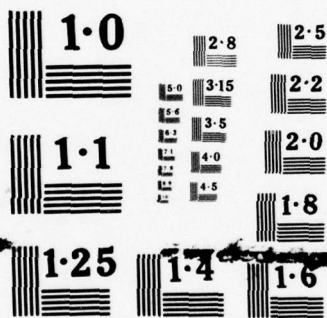
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drifted into the Morehead City channel where the waves were 5-8 ft (1.52-2.44 m) high. Waves started breaking over the starboard side completely swamping the boat. The bilge pump was turned on when waves started breaking into the boat, but water came in faster than the pump could evacuate. As the storm passed, the rain intensity decreased and he could see land approximately 100 yd (91.44 m) away. He grabbed the boat paddle and attempted to paddle the boat toward land which he later discovered was Radio Island. The water conditions were still very rough and he soon realized that he could not maneuver the boat by paddling.

### 3.3 Post-Accident

The boat seemed to be very stable, so he decided to stay in the boat until someone saw him. He did not consider trying to get one of the PFDs stored in the bow. Within 15 minutes after the storm hit, a large commercial fishing vessel saw the flooded boat and pulled alongside. The operator of the commercial vessel called the Fort Macon Coast Guard station over marine radio. The Coast Guard station dispatched a rescue vessel which arrived within five minutes after the call. Coast Guard personnel attempted to evacuate the water from the boat, but were unable due to a faulty pump. The operator of the involved boat was taken aboard the rescue vessel and the flooded boat was towed to the Coast Guard station where the water was evacuated by a dock side pump. (Refer to Figure 2 for a sketch of the accident area.)

### 3.4 Time Sequence of Accident Events

1830	-	Departed home for fishing area
0100	-	Arrived at launch ramp, launched boat and headed toward fishing spot
0110	-	Arrived at fishing spot and anchored boat
0110-0755	-	Fished from anchored boat
0755	-	Storm approached; operator decided to go to shelter of Coast Guard station
0757	-	Anchor broke loose and boat started drifting into channel
0757-0800	-	Breaking waves completely swamped boat
0800-0810	-	Operator attempted to paddle boat to land, abandoned effort and drifted in boat
0810	-	Commercial fishing vessel came alongside to assist; Coast Guard called by marine radio
0815	-	Coast Guard vessel arrived, took operator aboard and towed swamped boat to Coast Guard station

#### 4.0 VESSEL DATA

The boat was a 16'9" (5.1 m) tri-hull fiberglass runabout manufactured by Glastron in August, 1974. The motor was a 85 hp 1975 model Mercury. Styrofoam flotation was installed in the inner hull and high in the bow, stern and along the gunwales. Additional data obtained during examination of the boat were as follow:

- HIN - GOA33717M75A
- Maximum Beam Gunwale - 82 in. (208.28 cm)
- Maximum Transom Width - 66 in. (167.64 cm)
- Depth Amidships - 24 in. (60.96 cm)
- Transom Height - 20 in. (50.8 cm)
- Maximum Persons Capacity - 900 lb (408.24 kg)
- Maximum Weight Capacity - 1350 lb (612.36 kg)
- Maximum HP Capacity - 125

The boat hull received only minor gelcoat damage as a result of the accident. (Refer to Figures 3 - 6 for overall boat views.)

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator stated that he had been fishing in the accident area numerous times. He had been told that storms develop in that area very rapidly; therefore, he always stayed close to land so he could reach safety quickly. The storm caught him by surprise and since he had never been in very rough water he did not know how to cope with the situation.

Fatigue could very likely be a factor in this accident. The operator had not slept in 24 hours and it is possible that he was not alert enough to notice the approaching storm in time to get to safety.

## 6.0 PROBABLE CAUSE OF THE ACCIDENT

The following items are most likely the major factors in causing this accident:

- Sudden storm creating hazardous water conditions for this size boat is *considered the major factor in this accident.*
- Loss of motor resulting in loss of directional control is considered a significant factor.
- Fatigue on the part of the operator is considered a likely contributing factor. He did not realize a storm was approaching until it was too late.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

According to the estimated weight in the boat at the time of the accident, the boat was not overloaded. When the storm reached full force, the wind and waves caused the anchor to break loose allowing the boat to drift into deeper and rougher water. Loss of the motor resulted in loss of directional control which made it impossible for the operator to attempt to maneuver the boat to safety. Wave action caused the boat to turn broadside to the breaking waves. Waves broke over the side completely swamping the boat in a short time. The amount and location of the flotation material, particularly the material installed high in the gunwale, caused the boat to float in an upright and level attitude after flooding.

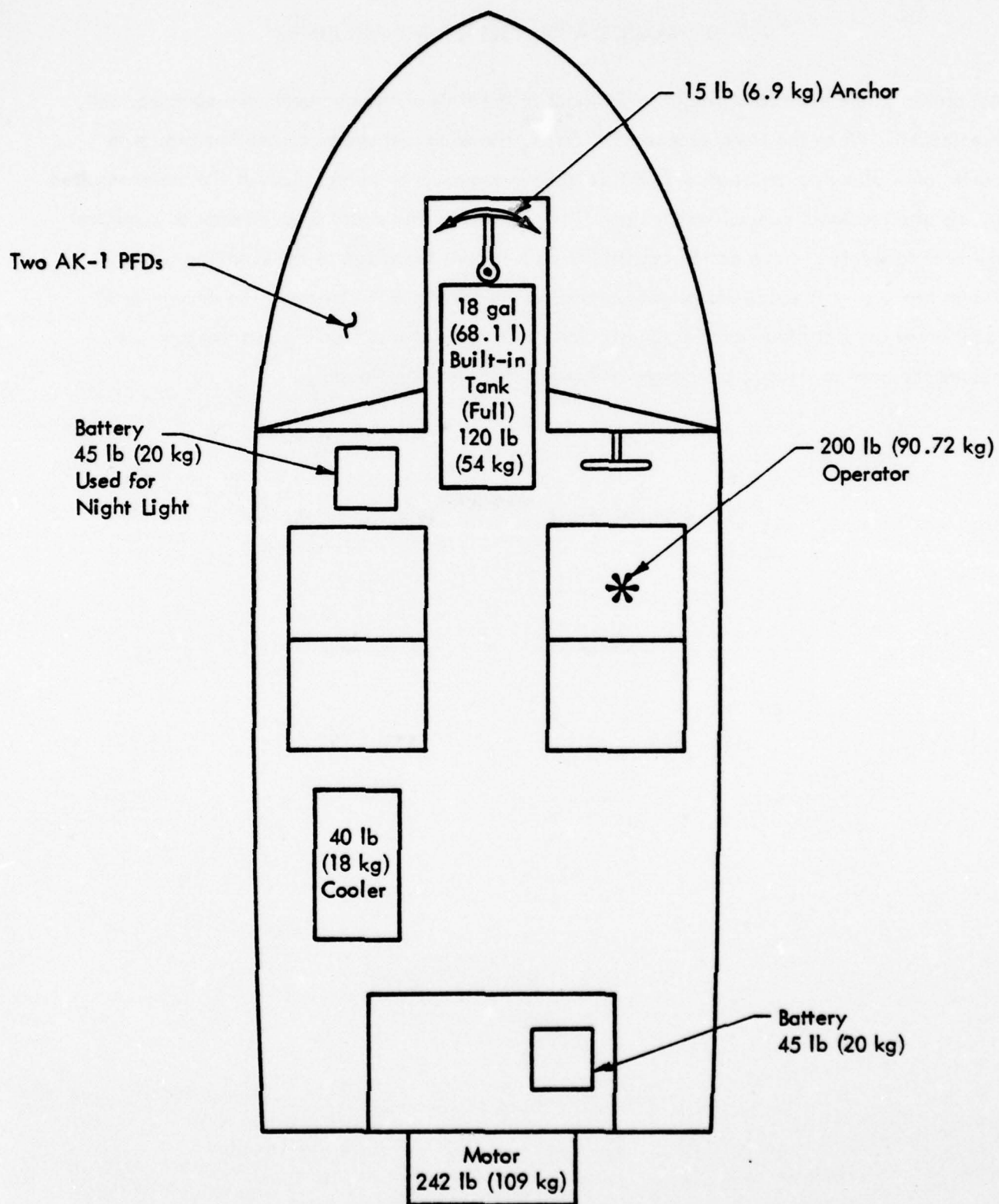


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

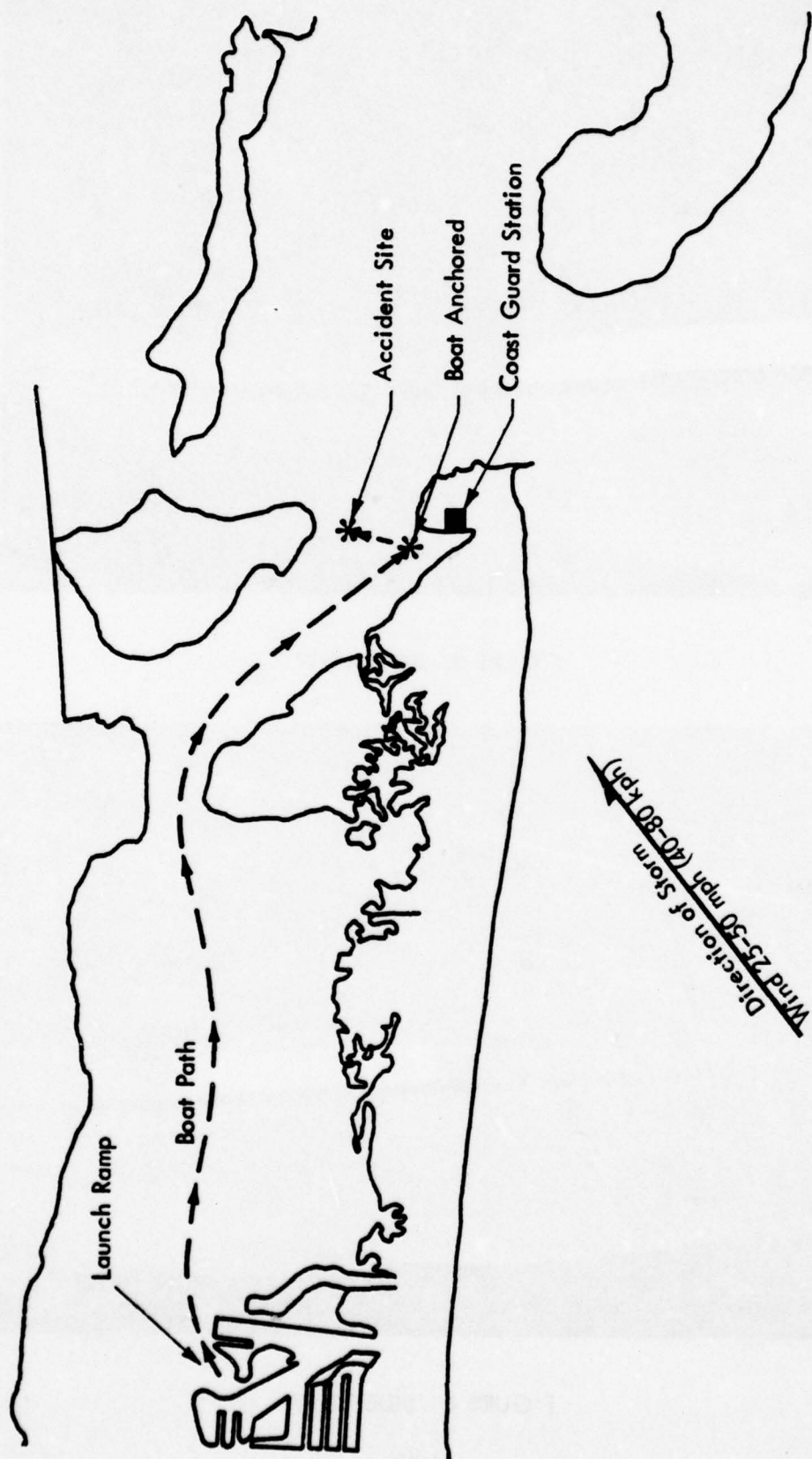


FIGURE 2. SKETCH OF ACCIDENT LOCATION

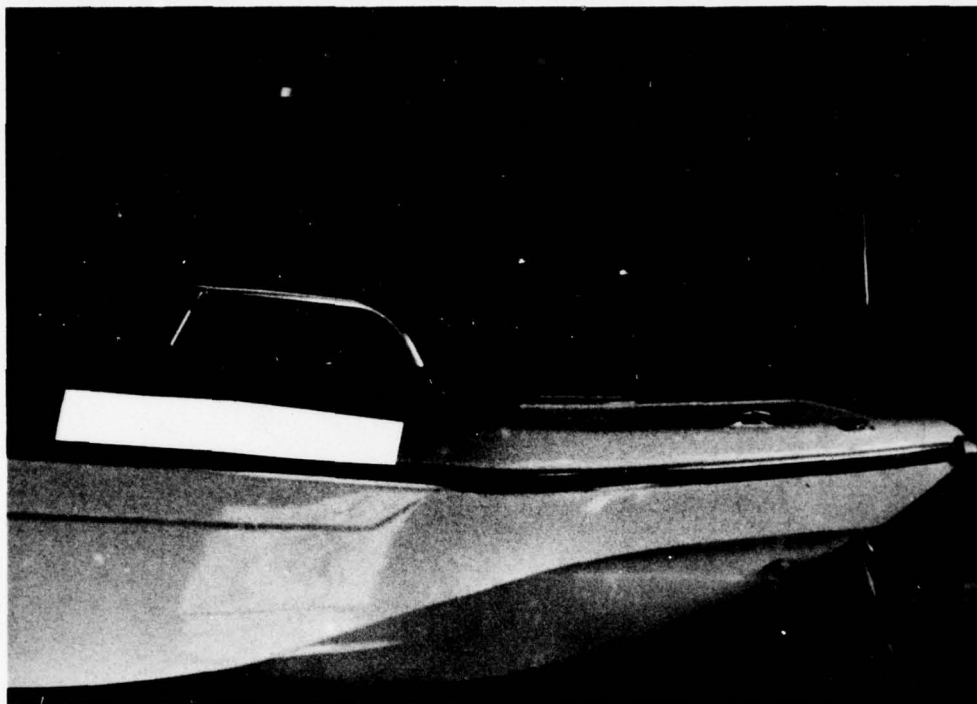


FIGURE 3. BOW VIEW

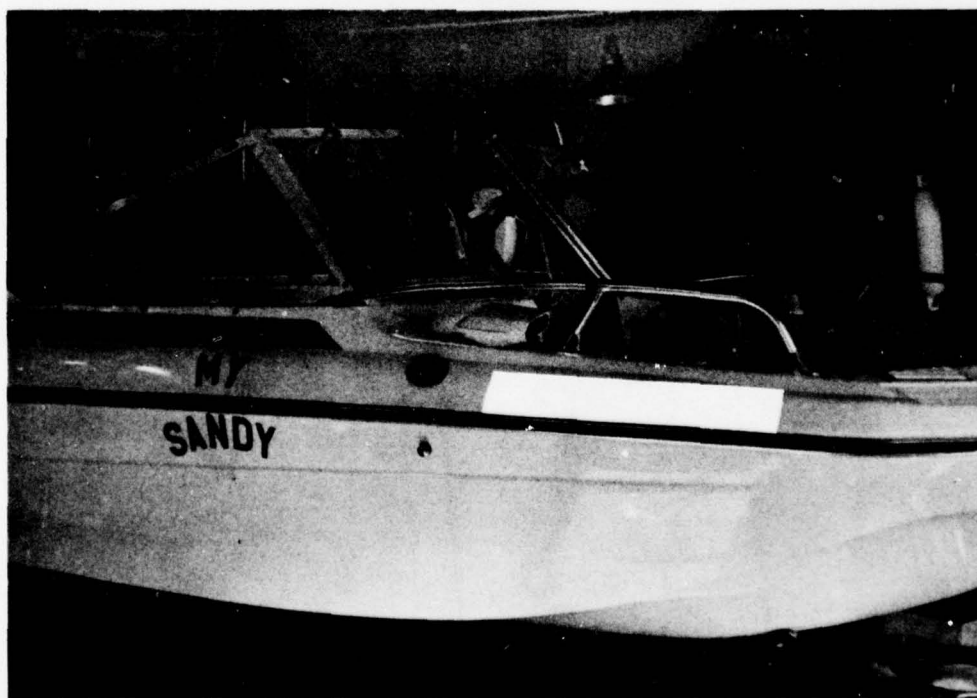


FIGURE 4. SIDE VIEW

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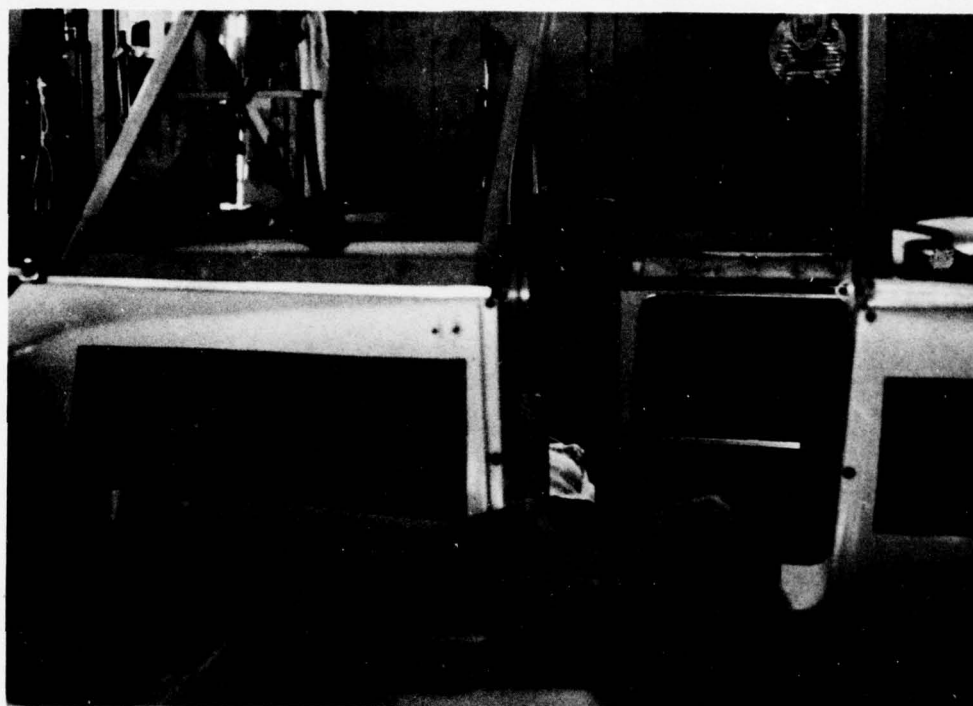


FIGURE 5. INTERIOR VIEW (BOW TO STERN)

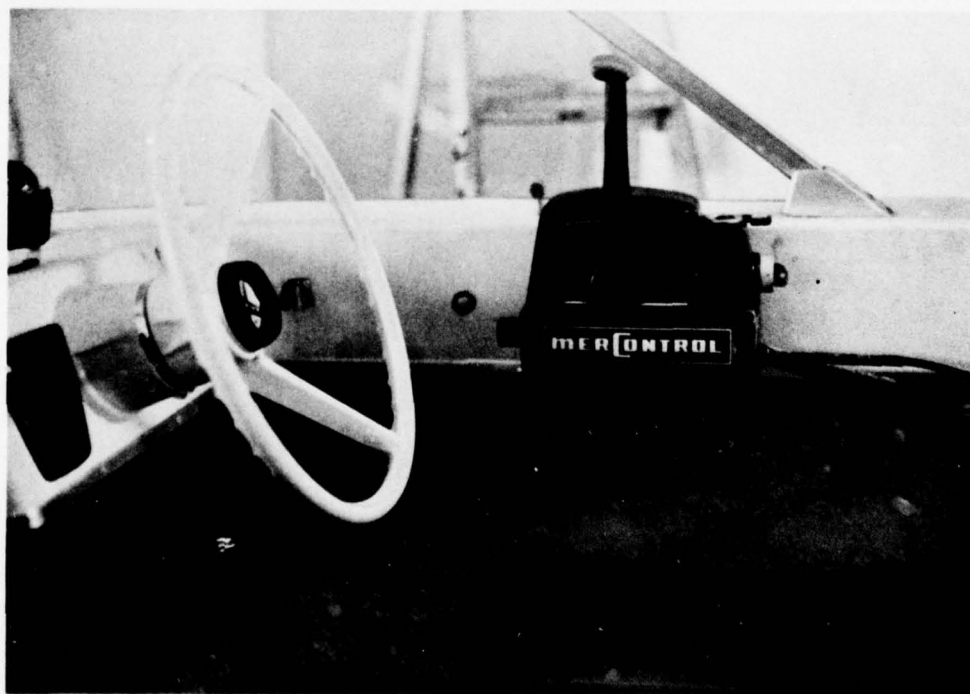


FIGURE 6. HELM

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### ACCIDENT INVESTIGATION REPORT

Date of Investigation: January 19, 1977

Date of Accident: December 13, 1976

Investigation: Capsizing/Swamping No. 76-22

### SUMMARY — WYLE ACCIDENT NO. 77-017

The accident reported herein involved a 16 ft (4.88 m) fiberglass runabout powered by a 115 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 2030 on December 13, 1976, three young men were preparing to drift fish off the Florida east coast approximately 1.5 miles (2.41 km) northeast of Boynton Inlet. The involved boat had been maneuvered to a fishing spot, the motor turned off and preparations were underway to deploy fishing lines. The wind velocity suddenly increased and within one minute was gusting to 25-30 mph (40.23-48.28 kph). Wave heights started to increase and the men decided to return to shore. Before they could get underway, several waves broke over the transom into the boat. When they did get underway, the boat would not come up on plane due to water in the stern. After traveling toward shore for approximately one minute, the fuel line at the motor came loose causing the motor to stop. The boat slowed abruptly allowing the stern wake to break over the transom flooding the boat sufficiently to reduce the transom freeboard to zero. Water then flowed freely over the transom completely swamping the boat, causing it to capsize. The occupants, wearing Type III PFDs, left the boat and swam approximately 1.5 miles (2.41 km) to shore. The boat later washed ashore and broke up on the rocks.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn/Used</u>	
							<u>Before</u>	<u>After</u>
Operator	M	21	165 lb (75 kg)	Good	400-500 hr	None	No	Yes
Passenger	M	20	150 lb (68 kg)	Excellent	200-300 hr	None	No	Yes
Passenger	M	19	140 lb (64 kg)	Good	50-100 hr	None	No	Yes

### 1.1 Owner/Operator

He was a high school graduate and had completed two semesters at a local junior college. He seemed to be of average intelligence and physical ability and was self-employed as a roofing contractor. He had operated boats since the age of seven and seemed to possess at least an average knowledge of boat operations in coastal waters. He was very familiar with the waters in the accident area and had fished in that area for the past thirteen years. All of his operating experience had been in small runabout outboards and johnboats.

### 1.2 Passengers

The passengers were not available for interview, but according to the operator they were of average intelligence and physical ability. Both were college students and worked part time installing floor tile for a local building contractor. Most of their boating experience had been in waters along the east central Florida coast. They had been on fishing trips in the accident area on the involved boat numerous times.

## 2.0 ENVIRONMENT

The sky was clear and the visibility was obstructed only by darkness. At the start of the trip, the wind was 5-7 mph (8.05-11.27 kph) with 1-2 ft (0.30-0.61 m) rolling swells. At the time of the accident, the wind velocity was 25-30 mph (40.23-48.28 kph) with 6-8 ft (1.83-2.44 m) breaking waves. The estimated air temperature was 80°F (27°C) and the estimated water temperature was 70°F (21°C). The water depth at the accident site was 60 ft (18.29 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

On the day of the accident, the owner/operator (1) worked on a residential roofing project from 0800 to 1700 arriving at his home at approximately 1715. On the way home from work, he drove along the beach near his home in Lakeworth, Florida, to visually check the sea conditions in case he decided to go fishing later that evening. He saw one of the passengers (2) also driving along the beach checking the sea conditions. After arriving home, he ate supper and relaxed around his home until approximately 1830.

Passengers 2 and 3 had worked together laying floor tile from 0800 until 1700. No. 3 went directly home from work and No. 2 drove by the beach on his way home. After arriving home Nos. 2 and 3 ate supper and No. 3 came over to No. 2's home at approximately 1830 to see if he wanted to go fishing. Nos. 2 and 3 decided on a fishing trip and called No. 1 to see if he wanted to go. No. 1 agreed to go and suggested they take his boat because it was more suited for fishing than the 26 ft (7.92 m) sailboat owned by No. 2. Nos. 2 and 3 arrived at No. 1's home at approximately 1845. The boat/trailer was connected to No. 1's pickup and the men departed for the launch ramp approximately one mile (1.61 m) away at 1850. They arrived at the ramp at approximately 1855, launched the boat, and loaded the fishing gear aboard. They departed the ramp at approximately 1900 destined for a fishing area in the Atlantic Ocean. They traveled south down the intercoastal approximately one-half mile (0.8 km) to Boynton Inlet. Arriving at the inlet, they saw a party drift boat located approximately one-half mile (0.8 km) east of the inlet. They decided to go out to that area to fish. They arrived at the fishing spot at approximately 1910 and drift fished until approximately 2010. The party boat powered up and started moving north toward Lake Worth. The occupants knew that the party boat had fish finding equipment aboard and decided to follow assuming the party boat would lead them to a better fishing location. At this time, it was dark and prominent objects could be distinguished only by light on and around them. The involved boat followed the party boat approximately one-half mile (0.8 km). At this point, the men decided that they did not want to go any further north, stopped their boat, and fished for approximately ten minutes.

The fish were not biting in that area, so the men decided to move further out in the ocean. The men went east from Manalapan to a point approximately one mile (1.61 m) off shore. The motor was stopped and the men rigged their fishing gear. As they worked with the fishing gear, they noticed that the wind velocity was increasing with occasional moderate gusts. No. 1 finished rigging first and cast out his line. Within a few seconds after he cast, a gust of wind hit the boat from astern ripping the windshield off the boat. The windshield landed in the water on the starboard side near No. 1. He grabbed it and placed it in the boat. The wind was now gusting to 25-30 mph (40.23-48.28 kph) and the seas were starting to build. Several waves broke over the transom in rapid succession. No. 1 told Nos. 2 and 3 that they had better head for shore before it got too rough. No. 1 started the motor while No. 2 reeled in No. 1's fishing line. No. 1 applied power and headed northwest toward shore at a 45 degree angle to the wind and waves. The inlet and passage to the launch ramp was southeast, but No. 1 decided he should head somewhat into the wind and waves until he got closer to calmer water near shore before he turned toward the inlet. No. 1 quickly discovered that the boat would not get on plane with full power due to water in the stern section. The boat was running at a speed of 5-7 mph (8.05-11.27 kph) in an extremely bow high attitude. No. 2 went forward to the center of the bow assuming his weight would lower the bow and increase the transom freeboard. The boat continued to run in a very stern low attitude.

Approximately one minute after getting underway, the fuel line detached from the motor causing abrupt motor stoppage due to fuel starvation.

### 3.2 Accident

Gear and people aboard were as shown in Figure 1 and the weather as noted in Section 2.0.

The boat stopped quickly in a bow high attitude. The stern wake came over the low transom swamping the stern section to the point that water was flowing freely over the transom. As the passenger compartment flooded, No. 1 removed three Type III PFDs from the storage compartment under the aft starboard seat, put one on and instructed the passengers to do the same. No. 1 got his CB radio that was under the helm seat and attempted to transmit a distress call. The CB had been submerged in water and would not operate. The aft half of the boat completely

filled with water, began to sink by the starboard stern, and simultaneously started a slow roll to starboard. As the boat rolled, the occupants jumped out over the starboard side. The boat continued to roll until it was in an upside-down, near level attitude.

### 3.3 Post-Accident

When the boat capsized, the port seat which was not secured to the deck floated free of the boat. The men swam to the seat and held to it for support. The seat was a lay down type constructed of four vinyl covered foam sections. The men discussed whether they should stay with the boat or swim approximately one mile (1.61 m) to shore. A decision was made to swim ashore based on the following:

- They did not know if the boat would remain afloat.
- It was very dark and no other boats were in the area. The possibility of being rescued by another boat seemed remote.
- The possibility of being attacked by sharks concerned them. The men had seen sharks in that area on previous outings.
- They were wearing PFDs, had the foam seats, and felt confident they could make it safely ashore.

The men set out for shore holding the seat for support and pushing it along in front of them. Lights on shore could easily be seen and they had no difficulty in keeping themselves oriented. At times, the men found it difficult to hold to the seat in the high wind and 6-8 ft (1.83-2.44 m) seas. After swimming for approximately 30 minutes, the men decided that two of them would ride on the seat and alternately one would swim and push the seat toward shore. This would allow each of them to have rest periods during the long swim. After swimming for approximately one hour, the men were approximately one-quarter mile (0.40 m) from shore. They shouted repeatedly hoping some one on shore would hear their call. At one point, the passengers removed their PFDs and waved them at people they could see around residences on shore. They put their PFDs back on after using them to signal. Apparently, nobody saw or heard them. As they neared shore they noticed that a returning party drift boat had apparently spotted the capsized boat and was searching the accident area with a spotlight. After reaching

shore, the men went to a beach side residence where No. 1 called the local Coast Guard station and reported the accident. No. 1 was told the party boat would be notified by marine radio that the occupants of the capsized boat were safe and a Coast Guard vessel would be dispatched to tow the boat ashore. Apparently, the Coast Guard vessel was unable to find the boat because No. 1 was notified the next morning that the boat had drifted ashore and had broken up on the rocks. No. 1 was directed by the local sheriff's department to remove the salvage from the beach. He cut the hull in sections and hauled it to a land fill. (Refer to Figure 2 for a sketch of the accident area.)

### 3.4 Time Sequence of Accident Events

- |           |   |  |
|-----------|---|--|
| 1845      | - | Left operator's home for launch ramp   |
| 1900      | - | Arrived at ramp, launched boat, and headed for fishing area  |
| 1915      | - | Arrived at fishing area near party drift boat located approximately one-half mile (0.8 km) east of Boynton Inlet |
| 1915-1945 | - | Drift fished near party boat   |
| 1945      | - | Drift boat headed north; involved boat followed  |
| 2000      | - | Involved boat stopped after following party boat approximately one-half mile (0.8 km)                            |
| 2000-2115 | - | Drift fished in second location  |
| 2115      | - | Headed out to sea to third fishing location  |
| 2125      | - | Arrived at third location approximately one mile (1.61 m) off shore  |
| 2125-2127 | - | Prepared rigging for drift fishing   |
| 2127      | - | High wind gust ripped windshield from boat   |
| 2128      | - | Waves broke over transom partially swamping boat   |
| 2129      | - | Boat headed toward shore   |
| 2130      | - | Fuel line detached from motor and motor stopped  |
| 2130-2132 | - | Boat flooded and capsized  |
| 2132-2133 | - | Men discussed what action to take  |
| 2133      | - | Men started swimming ashore  |
| 2300      | - | Men safely reached shore and notified Coast Guard  |

#### 4.0 VESSEL DATA

After the accident, the boat was scrapped and taken to a land fill. The following vessel data was obtained from the owner/operator.

The boat was a 16 ft (4.88 m) tri-hull fiberglass runabout manufactured by Chrysler in 1969. The motor was a 115 hp 1970 model Evinrude outboard. The original seats had been removed by the owner and replaced by seats he had built. The helm seat was a foam vinyl covered swivel seat. Immediately behind the helm seat was a foam vinyl covered side facing bench seat large enough to accommodate two adults. The starboard seats were back-to-back and were constructed of four foam vinyl covered sections which could be positioned flat, making the seats into a bed. (Refer to Figure 1 for a sketch of the boat.)

#### 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

All of the occupants in the involved boat were experienced boaters and were very familiar with the waters in the accident area. Fishing was good and their primary concern before the accident occurred was catching fish. Their familiarity with the area and their preoccupation with fishing could have caused them to ignore or not be aware of the deteriorating weather conditions. It is unlikely that the wind and water conditions changed drastically within a matter of minutes as stated by the operator, particularly since no thunderstorms were in the area at that time.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- Operating this size boat in the conditions that existed at the time of the accident is considered the major factor.
- Water weight in the stern caused the boat to run in a very stern low attitude. Sudden motor stoppage caused the boat to stop rapidly in a stern low attitude allowing the stern wake to break over the transom.
- Loss of directional control after the motor stopped prevented the operator from maneuvering the boat into the wind and waves.
- Failure of the occupants to notice or react to deteriorating weather conditions.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

The following is presented based on the narrative and knowledge of the boat characteristics. According to the estimated weight in the boat at the time of the accident, the boat was not overloaded. However, considering the water weight in the stern, the safe maximum weight capacity was most likely exceeded. The water weight in the aft section reduced the transom freeboard significantly and caused the boat to run in a very stern low attitude. When the boat abruptly stopped, the water in the aft section caused the boat to continue to assume a stern low attitude. The transom freeboard was reduced to the point that the stern wake broke over the transom reducing the freeboard to zero. Water freely flowed over the transom completely swamping the aft half of the boat. Flotation material in the inner hull caused the boat to have a natural tendency to roll when flooded. The location of the flotation material made the boat float essentially level and stable in an upside-down attitude.

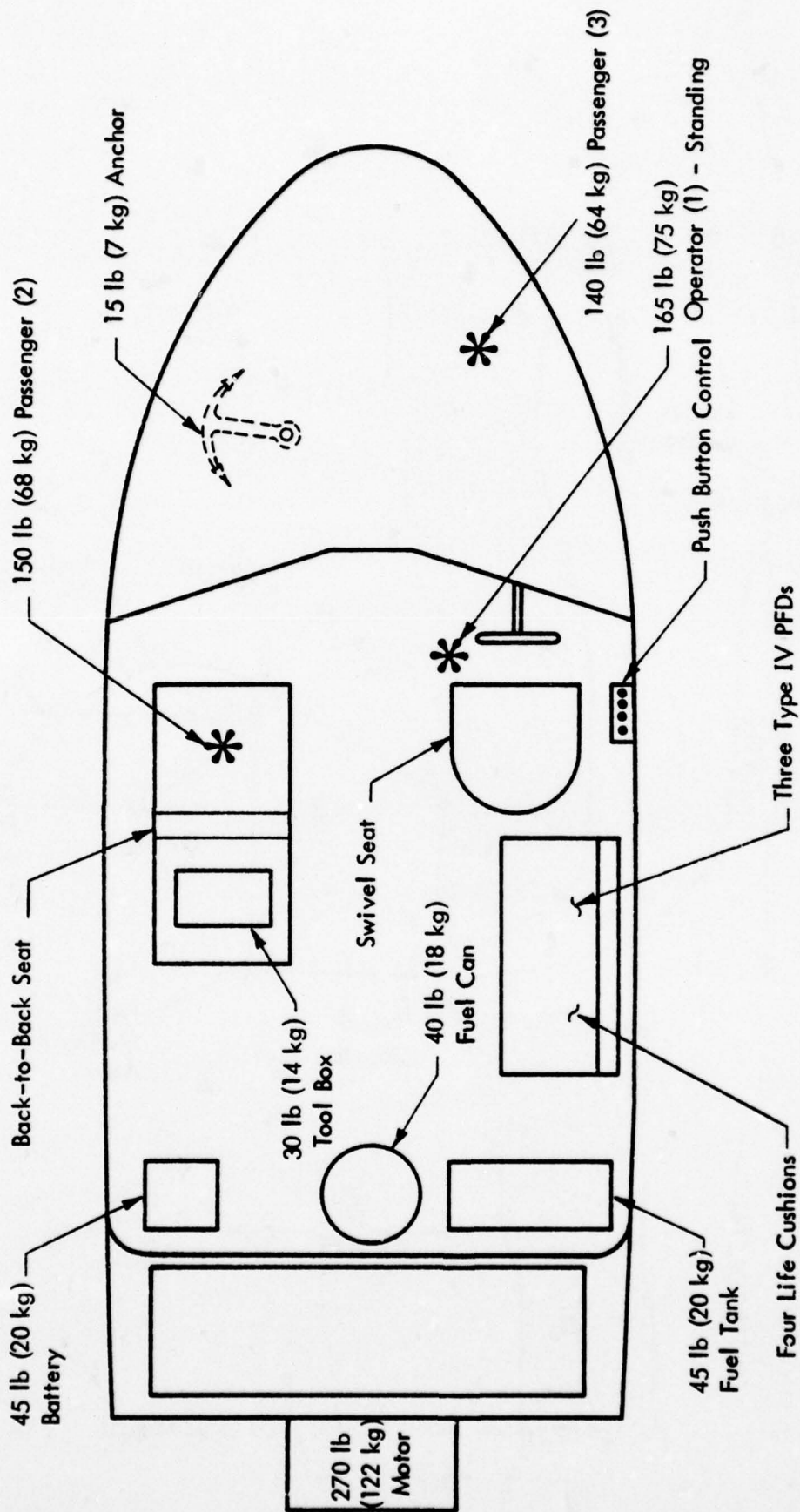


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

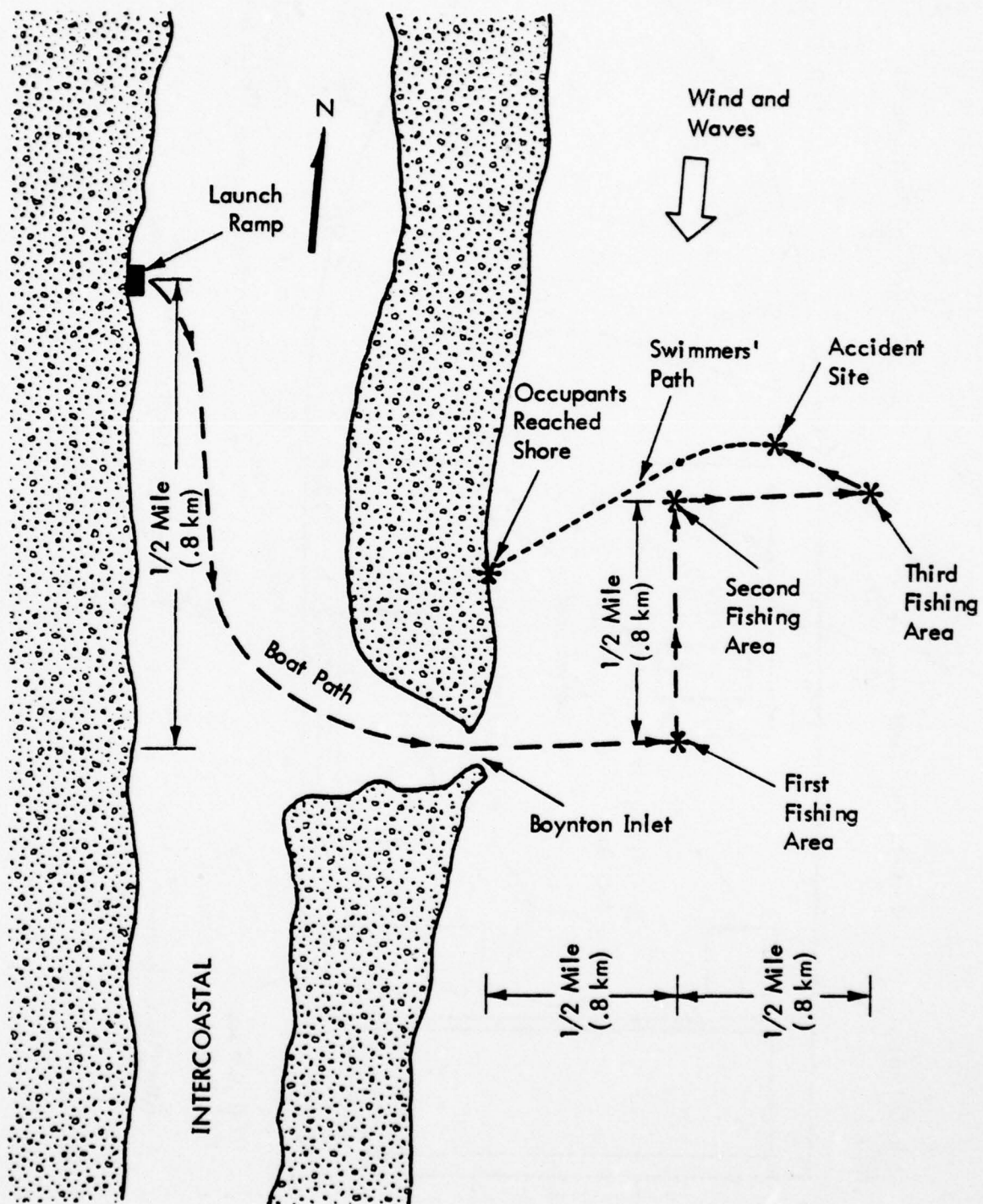


FIGURE 2. SKETCH OF ACCIDENT AREA

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: January 20, 1977

Date of Accident: November 6, 1976

Investigation: Capsizing/Swamping No. 76-23

### SUMMARY — WYLE ACCIDENT NO. 77-018

The accident reported herein involved a 16 ft (4.9 m) fiberglass semi-V runabout powered by a 115 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injuries or fatalities.

At approximately 1400 on November 6, 1976, two men had finished a three hour scuba diving outing in a reef area located approximately one mile (1.6 km) southeast of Hillsboro Inlet in the Atlantic Ocean. Prior to diving, the men had deployed a diving marker held in place with a 15 lb (6.8 kg) Danforth Anchor. The boat was secured to the diving marker anchor line. The men had finished diving and climbed into the boat. The operator, wearing a wet suit, went to the helm to start the motor. The passenger, wearing a wet suit, started trying to break the anchor loose from the ocean bottom. The anchor line became entangled around his right leg and as the boat was moved by wave action it was pulled tight against the starboard side at the stern. Fearing injury to his leg, he put his left foot on the starboard gunwale and pulled very hard on the line trying to break the anchor loose. The anchor did not break loose and he exerted enough force on the line to cause the starboard stern, because of wave action, to submerge allowing water to flow freely into the boat. After a considerable amount of water had come into the boat, he managed to free his leg. Water continued to flow in until the boat flooded and capsized. The men were rescued by a nearby C.G. Auxiliary boat.

## 1.0 BOAT OCCUPANT DATA

<u>Operator/ Passenger</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs</u>	
							<u>Worn/Used Before</u>	<u>After</u>
Operator	M	29	200 lb (91 kg)	Good	> 500 hrs	None	No	No
Passenger	M	29	150 lb (68 kg)	Excellent	> 200 hrs	None	No	No

### 1.1 Owner/Operator

He was a high school graduate and seemed to be of average intelligence and physical ability. He considered himself to be an expert scuba diver. Although he had owned the involved boat for 10 years and stated he had over 500 hrs boat operating experience, he did not seem very knowledgeable concerning small boat operation. He was unfamiliar with some of the basic nautical terms such as port, starboard, beam, etc. He had recently moved to Florida from Pennsylvania and had never been in the ocean in a small boat. All of his boating experience had been in Lake Erie.

### 1.2 Passenger

He was not available for interview. According to the operator, he was of average intelligence and above average physical ability. He also was considered to be an expert scuba diver. Most of his boating experience had been in his 26 ft (7.9 m) motor sailer. He had scuba dived in the accident area three or four times and was somewhat familiar with the waters in that area.

## 2.0 ENVIRONMENT

The sky was clear and the visibility was good. The seas were 4-6 ft (1.2-1.8 m) rolling swells and the wind was from the southwest at 15-25 mph (24.1-40.2 kph). The estimated air temperature was 80°F (27°C) and the estimated water temperature was 70°F (21°C). The water depth in the accident area was approximately 15 ft (4.6 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

During the week before the accident, the owner/operator (No. 1) and a friend (No. 2) had planned a scuba diving outing in the Atlantic Ocean near Ft. Lauderdale, Florida. After getting off work at 1700 on Friday, November 5, 1976, the men loaded the diving gear in the boat, connected the boat/trailer to No. 1's automobile and departed No. 1's home in Dunedin, Florida, at approximately 1730 destined for Ft. Lauderdale approximately 200 miles (321.9 km) away. They arrived at the home of No. 2's brother in Fort Lauderdale at approximately 2130. They went to bed at approximately 2400 and arose the next morning at approximately 0800. They ate breakfast and talked to No. 2's brother until 1030, then departed for a launch ramp on the Intercoastal Waterway approximately 10 miles (16.1 km) away, arriving at approximately 1050. The boat was launched, the diving gear checked and they got underway from the launch ramp at approximately 1100. Their destination was one of three reefs located about one mile (1.6 km) out from Hillsboro Inlet. They traveled one-half mile (0.8 km) north up the ICW, through Hillsboro Inlet, then toward the reef area. The reefs were nearly 15 ft (4.6 m) below the surface and were difficult to locate visually. At 1110, the men located the southern-most reef. A Danforth Anchor was deployed with the anchor line tied to a diving marker. The boat was also tied to the anchor line from the starboard stern gunwale cleat. The men donned wet suits and diving gear and dived in the reef area until approximately 1400. During this time, the wind velocity increased from 5-7 mph (8.0-11.3 kph) to 15-25 mph (24.1-40.2 kph) and the wave height increased from 1-2 ft (0.3-0.6 m) to 4-6 ft (1.2-1.8 m). The men climbed aboard and removed their diving equipment. No. 1 went to the helm to start the motor while No. 2 started pulling in the anchor. The anchor was apparently caught on the reef and would not break loose. While attempting to free the anchor, No. 2's right leg became entangled in the slack anchor line in the boat. Wave and wind action caused the line to become tight, pulling No. 2's leg hard against the starboard side at the stern. Concerned that his leg could be injured, No. 2 put his left foot on the starboard gunwale and pulled as hard as he could on the line in an attempt to free the anchor. He applied enough pressure on the gunwale to reduce the starboard stem freeboard to zero, allowing water to flow freely into the boat.

### 3.2 Accident

Gear and people aboard were as shown in Figure 1, and the weather as noted in Section 2.0.

No. 2, preoccupied with freeing his leg, did not realize that water was coming into the boat until the aft section was flooded. He managed to free his leg and released the anchor line. No. 1, seated at the helm, felt the stern go down, turned around and observed that water was flowing over the transom into the boat. He quickly turned the ignition to the start position, but apparently the battery had shorted and the motor would not turn over. No. 2 jumped out of the boat over the starboard side to decrease the weight in the stern. No. 1 climbed over the windshield and positioned himself on the forward top of the bow in an attempt to increase the transom freeboard. Water continued to flow into the boat until the transom submerged. At this point, the boat started a slow roll to starboard. As the boat rolled, No. 1 slid off the bow into the water. The boat continued to roll until it was in an upside-down bow high attitude.

### 3.3 Post-Accident

A Coast Guard Auxiliary boat cruising approximately 100 yds (91.4 m) away saw the capsizing and immediately came to assist. The occupants of the involved boat were wearing wet suits and had no difficulty holding to the capsized boat. Nos. 1 and 2 were taken aboard the rescue vessel within two minutes after the accident. A line was tied to the bow of the capsized boat and it was towed inside Hillsboro Inlet by the rescue vessel. No attempt was made to right the boat until inside the inlet because of the hazardous water conditions. After reaching the inside of the inlet where the water was calmer, the boat was righted and the water evacuated by a portable pump. The boat and its occupants were then towed to the 14th Street boat ramp. All diving equipment was lost when the boat capsized. (Refer to Figure 2 for a sketch of the accident area.)

### 3.4 Time Sequence of Accident Events

- 1030 - Departed for launch ramp
- 1050 - Arrived at launch ramp, launched boat, and loaded diving equipment aboard
- 1100 - Departed launch ramp destined for diving area
- 1110 - Located reef approximately one mile (1.6 km) offshore
- 1110-1400 - Dived in reef area
- 1400 - No. 2 tried to retrieve anchor securing diving marker
- 1400-1401 - No. 2 jumped overboard and No. 1 moved forward to stop ingress of water
- 1401-1402 - Boat swamped and capsized
- 1402-1404 - Occupants held to capsized boat
- 1404 - Occupants rescued by nearby CGA boat
- 1404-1408 - Capsized boat tried off to rescue vessel
- 1408-1539 - Rescue vessel towed involved boat to inside of inlet
- 1539-1545 - Capsized boat righted and water evacuated
- 1545-1600 - Involved boat towed to ramp

#### 4.0 VESSEL DATA

The boat was a 16 ft (4.9 m) fiberglass semi-V runabout, Sabre model, manufactured by Chutchfield Marine in 1966. Flotation material was installed in the inner hull. The hull received only minor gelcoat damage on the bottom as a result of the accident. The boat was powered by a 1972 model 115 hp Mercury outboard motor. Additional data obtained during the investigation were as follows (labeled capacities were on an OBC plate):

- Maximum Beam - Gunwale - 77.25 in. (196.2 cm)
- Maximum Beam - Chine - 61 in. (154.9 cm)
- Maximum Transom Width - 72.5 in. (184.2 cm)
- Depth Amidships - 25.5 in. (64.8 cm)
- Transom Height - 20.5 in. (52.1 cm)
- Maximum Persons Capacity - 4 persons at 150 lb (68 kg) each
- Maximum Horsepower Capacity - 110

(Refer to Figures 3-7 for overall boat views.)

#### 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The owner/operator was unfamiliar with the waters in the accident area. He thought the ICW was a river. It was apparent from the interview that he had very little interest in small boats other than a means of transportation to and from scuba diving areas. He was very uncooperative and unfriendly during the interview. Information about the accident was obtained only through repeated direct questioning by the interviewers. It is the opinion of the investigators that this individual was not concerned about the safe operation of his boat, did not know or care where he was, and was not concerned about sea conditions. He was wearing a wet suit and felt confident he would survive a sinking. His only concern during the outing seemed to be getting to the diving area and engaging in scuba diving activity.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- Lack of concern for water conditions on the part of the occupants is considered the major contributing factor. The water conditions exceeded the safe operating limits for this type boat.
- Anchoring by the stern in rough water is contrary to safe operating practices.
- Panic on the part of the passenger is considered a major factor. He physically pulled the stern below the surface when his leg became entangled in the anchor line.

## 7.0 DYNAMICS/ANALYSIS OF ACCIDENT

The following is presented, based on the narrative and knowledge of the boat characteristics. According to the estimated weight in the boat at the time of the accident, the boat was not overloaded. The maximum recommended horsepower was exceeded by five horsepower, which is not considered a factor. The boat was anchored by the stern, which positioned the stern of the boat into the wind and waves. The passenger pulled on the anchor line, which applied sufficient pressure on the gunwale to reduce the transom freeboard to zero. The freeboard was held at zero long enough to allow the aft section to fill with water. Free-flowing water over the transom aided by waves breaking into the boat completely swamped the aft section. The flotation material installed in the inner hull made the boat have a natural tendency to capsize when flooded. The location of the flotation material made the boat very stable in a upside-down attitude.

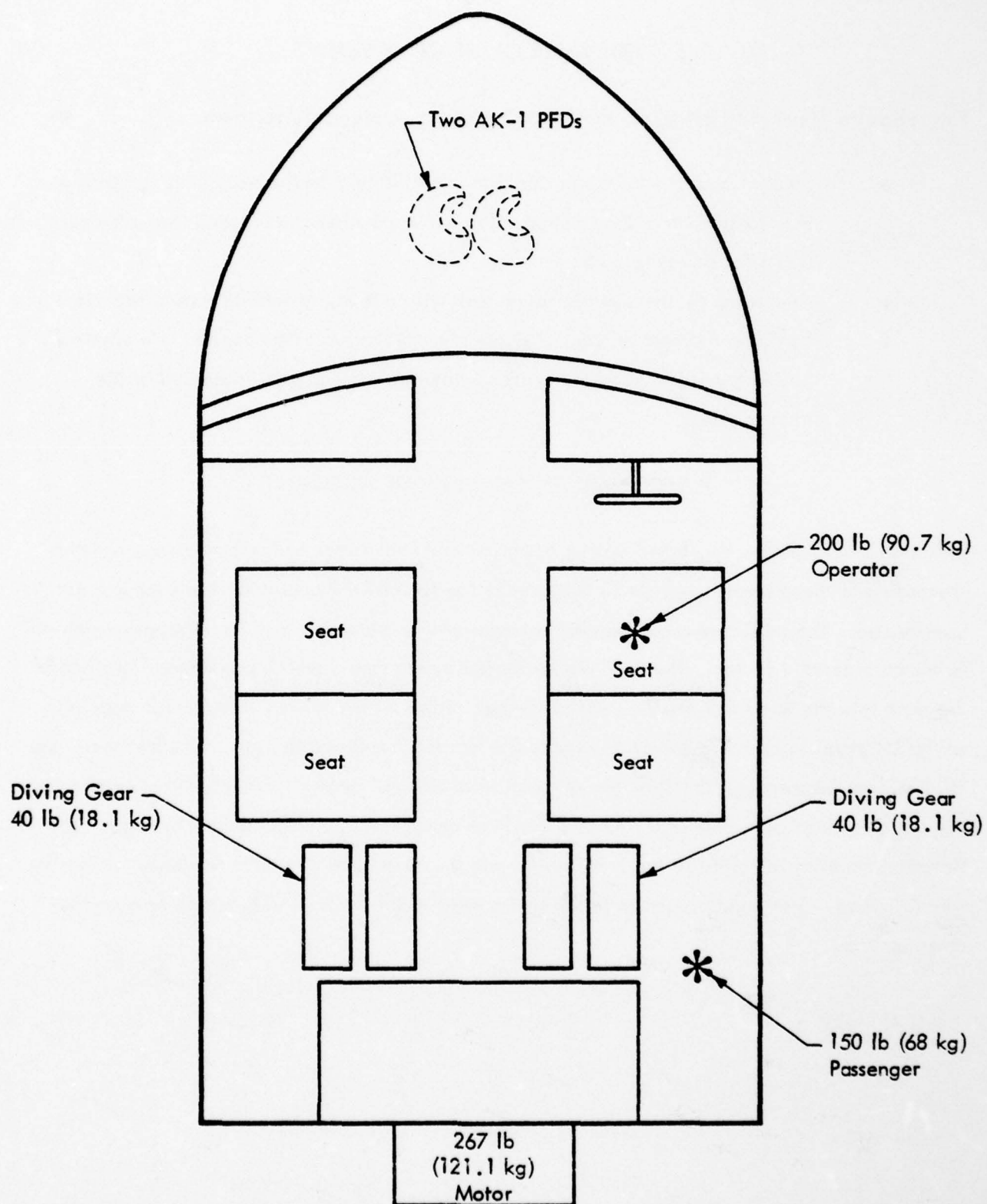


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

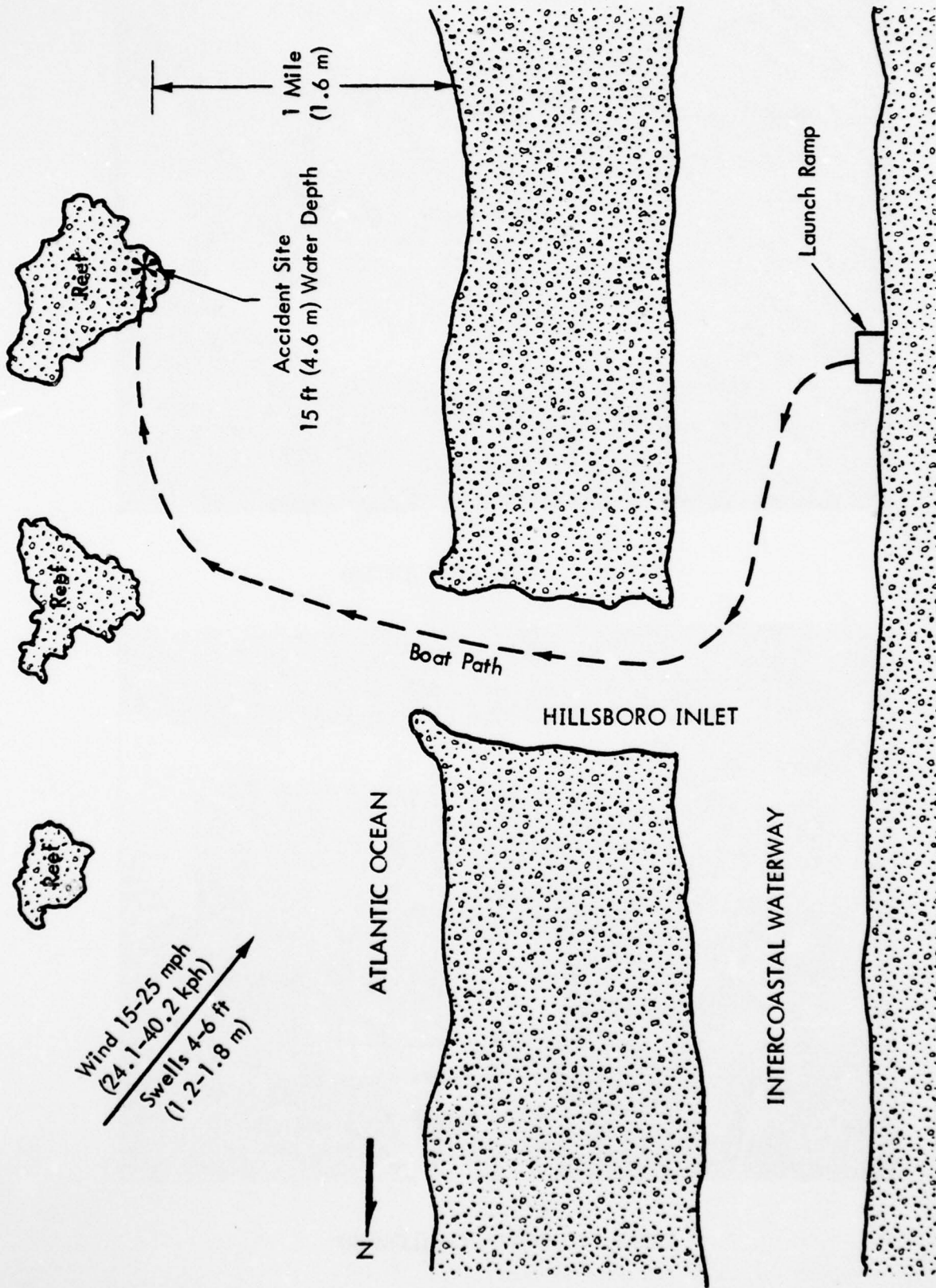


FIGURE 2. SKETCH OF ACCIDENT AREA

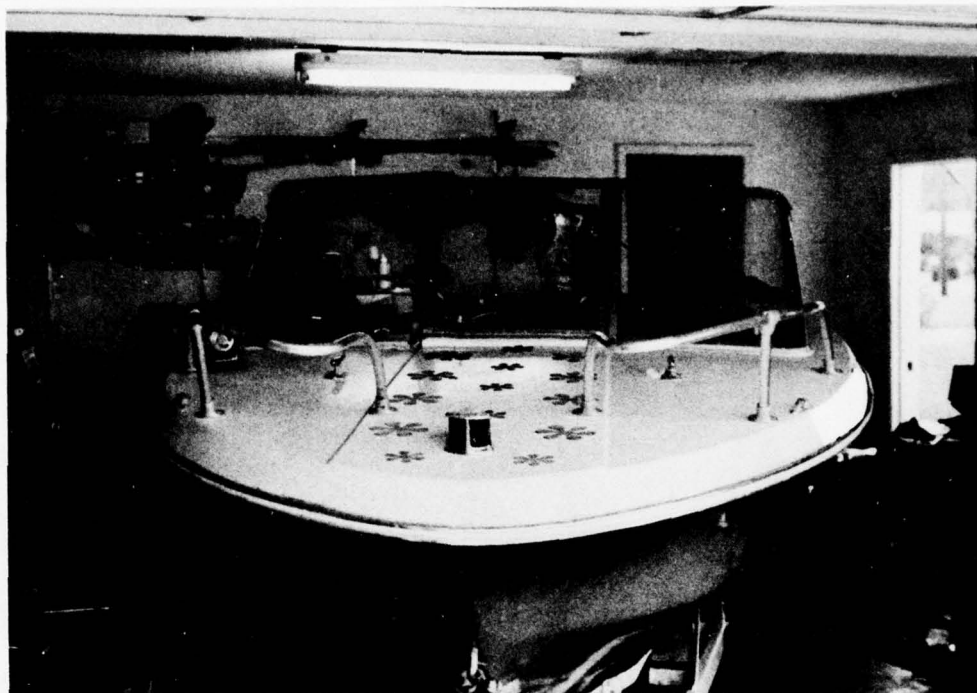


FIGURE 3. BOW VIEW (UPPER)

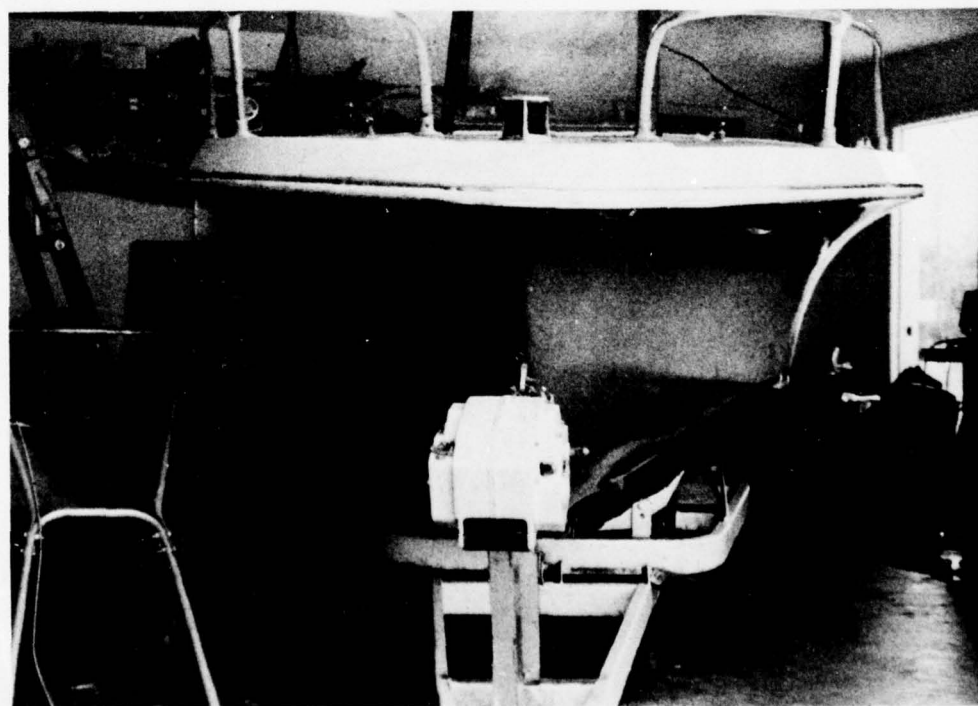


FIGURE 4. BOW VIEW (LOWER)

W-10

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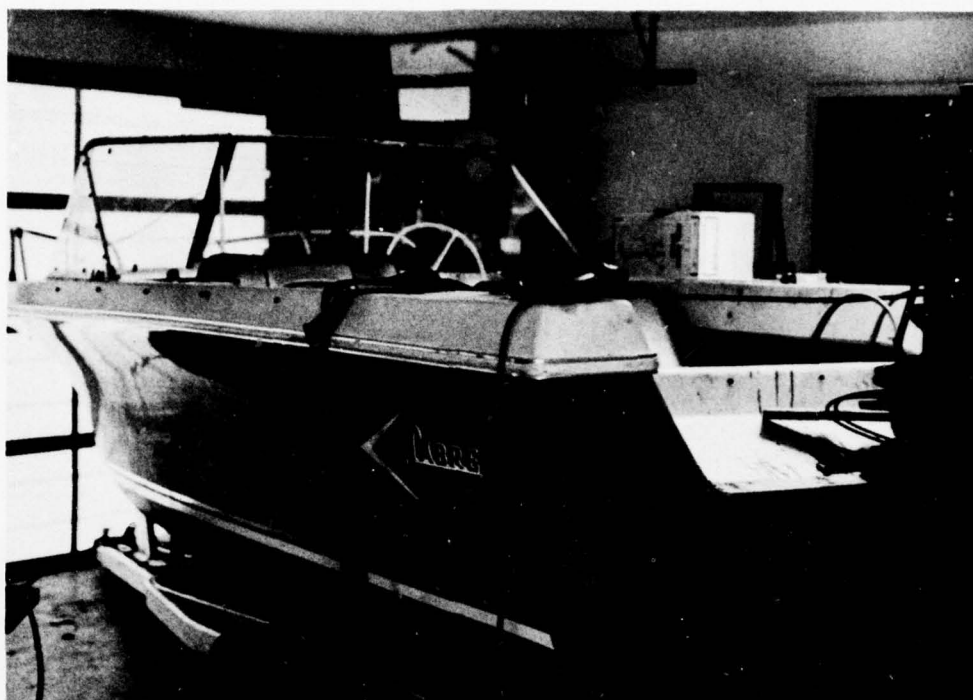


FIGURE 5. STERN VIEW

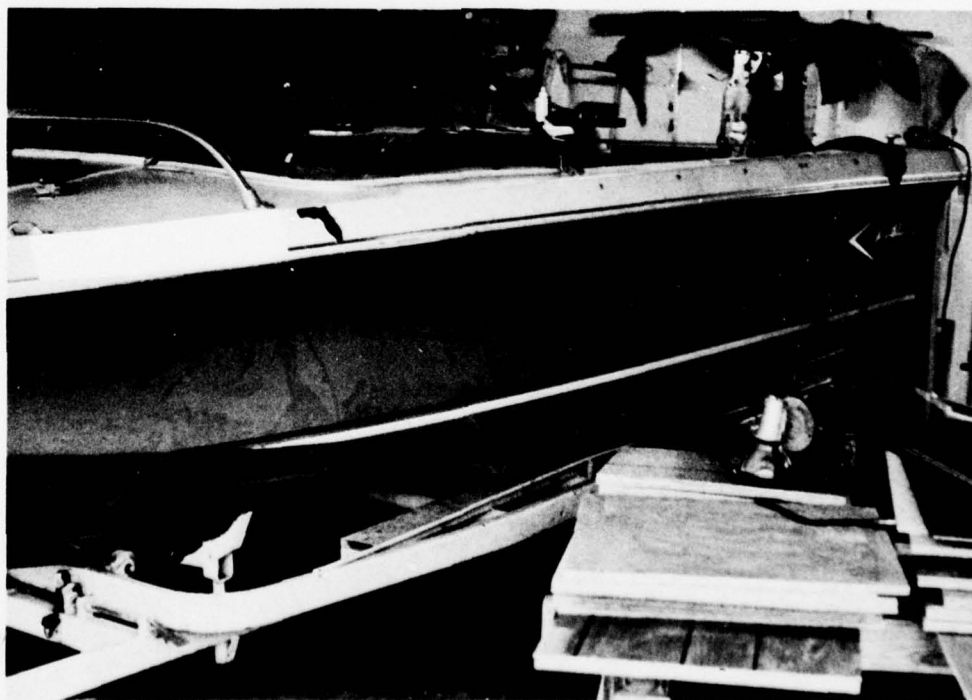


FIGURE 6. SIDE VIEW

W-11

327

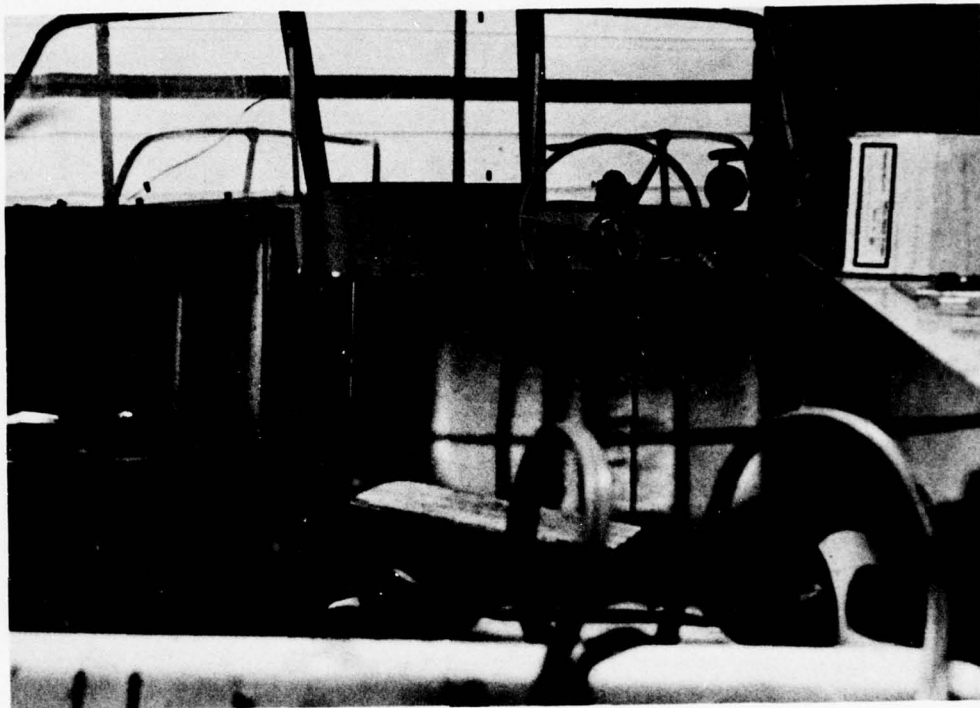


FIGURE 7. INTERIOR VIEW

W-12

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## ACCIDENT INVESTIGATION REPORT

Date of Investigation: January 20, 1977

Date of Accident: January 14, 1977

Investigation: Capsizing/Swamping No. 76-24

### SUMMARY — WYLE ACCIDENT NO. 76-016

The accident reported herein involved a 15.5 ft (4.7 m) tri - hull bowrider powered by a 40 hp outboard motor. The type of accident was a swamping resulting in no injuries or fatalities.

At approximately 2200 on January 14, 1977, four adult males were going through Hillsboro Inlet in southeast Florida destined for a fishing area approximately one mile out in the Atlantic Ocean. Midway through the inlet, the water conditions suddenly became very rough. The men could see the ocean was too rough for their boat and decided not to go out. The operator told the passengers that it was too rough to turn around in the inlet and they would have to go outside the inlet, turn around, and come back through the inlet. After travelling approximately 25 yds (22.9 m) at idle speed. A wave broke over the stern partially swamping the boat and causing the motor to stop from water intake. The operator tried to restart the motor, but was unsuccessful. The boat turned broadside to the wind and waves and was completely swamped within a short period of time. The boat drifted around the north end of the inlet and was washed near the ocean side of a jetty. The occupants stayed in the boat until it drifted near the jetty. One of the occupants got out and held the boat in place until the other occupants climbed out on the jetty. Within 30 minutes the boat sank to the bottom and came to rest in an upright position [6-8 ft (1.8-2.4 m) water depth].

## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Instruction	PFDs Worn	
							Before	After
Operator	M	32	155 lb 70.31 kg	Good	10 hr	None	No	No
Passenger	M	30	155 lb 70.31 kg	Excellent	10 hr	None	No	No
Passenger	M	33	180 lb 81.65 kg	Good	10 hr	None	No	No
Passenger	M	37	165 lb 74.84 kg	Good	10 hr	None	No	No

### 1.1 Owner/Operator

The owner was a high school graduate and seemed to be of average intelligence and physical ability. He was self-employed as a residential remodeling contractor. He had owned the involved boat two months and had been out only two times previous to the night of the accident. The two outings had been fishing trips in the daytime in the ICW. He had never been out in the ocean. He was unfamiliar with the waters in the accident area and knew very little about the proper operation of a small boat. He had never been around boats and had no interest in them until he went on a fishing trip with a friend who owned a 16 ft (4.9 m) runabout. He enjoyed this outing and decided to purchase a boat.

### 1.2 Passengers

Passengers 2 and 3 were high school graduates and seemed to be of average intelligence and physical ability and were employed by the owner/operator in his remodeling business. Passenger 4 had been stricken with polio as a child and was unable to walk. He was confined to a wheelchair. Despite his physical impairment, he was considered a good swimmer. He was a high school graduate and seemed to be of average intelligence. None of the passengers had ever owned a boat and knew very little about boat operations.

## 2.0 ENVIRONMENT

The sky was clear and the wind was from the southwest at an estimated velocity of 15 - 25 mph (24.1 kph - 40.2 kph). The water was calm in the ICW with wave height increasing to 4-6 ft (1.2 m - 1.8 m) in the inlet and the ocean. The estimated air temperature was 70° F (21.1° C) and the estimated water temperature was 60° F (15.5° C). The water depth in the accident area was approximately 8 ft (2.4 m).

## 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

### 3.1 Pre-Accident

During the week prior to the accident, the owner/operator and passengers decided to go on a fishing trip after work on Friday, January 14, 1977. Passengers 1, 2, and 3 worked on a remodeling job from 0800 to 1700 on Friday and went directly home from work. Passenger 4 was unemployed and stayed around his home Friday. The passengers came over to No. 1's home at approximately 1800 and sat around drinking beer until approximately 2000. According to No. 1, each man consumed at least three beers. The men departed for the launch ramp approximately 10 mi (16.1 km) away in No. 1's van with the boat/trailer in tow. After stopping for fish bait and two six-packs of beer, they arrived at the launch ramp on the ICW at approximately 2020. The boat was launched, gear loaded aboard and they departed the launch ramp down the ICW at approximately 2030. They traveled approximately 3 mi (4.8 km) to Hillsboro Inlet, stopping in several places to fish. They arrived at the inlet at approximately 2155. No fish had been caught and the men decided to go out the inlet and see if fishing was any better in the ocean. No. 1 had been told by an experienced fisherman friend that fishing was usually good about a mile out from the inlet. No. 1 remembered that his wife had told him that, according to a weather report she had heard on the radio during the day, that the inlet would be choppy. He informed the passengers of this report, they all discussed it, then decided to go out and take a look. As the boat approached the inlet, the occupants could see that the water conditions in the inlet were as forecasted. No. 1 noticed a flashing light on the north side of the inlet, which he assumed was a small craft warning signal (light was probably obstruction light on radio antenna tower). The inside of the inlet was not very rough and the men decided to go through.

### 3.2 Accident

Gear and people aboard were as shown in Figure 1 and the weather as noted in Section 2.0.

As the boat reached a point adjacent to the jetty on the north side of the inlet, the water conditions suddenly became very rough [4-6 ft (1.2-1.8 m) waves]. The operator started to turn the boat around, but realized the boat would most likely capsize if a turn was attempted at this point. He decided to continue straight ahead to see if water conditions were calmer outside the inlet. After traveling approximately 25 ft (7.6 m), a large wave broke over the transom and motor causing the motor to stop from water intake. The boat turned broadside to the waves and within one minute was completely swamped by waves breaking over the port side. No. 1 had been told when he purchased the boat that it had flotation material installed and would not sink. He informed the passengers of this and instructed them to stay in the boat until they were rescued or drifted ashore. Within five minutes, the boat drifted northeast around to the ocean side of the jetty on the north side of the inlet, then westward near the rocks of the jetty.

### 3.3 Post Accident

Passenger 3, seated in the port bow seat, climbed out over the port side and tied the bow line to a rock. Wave action was causing the boat to roll and pitch violently, occasionally impacting rocks on the jetty. The remaining occupants decided to stay in the boat because they were afraid if they got out and attempted to get to the jetty, they would be crushed between the rocks and the boat. At this point, the operator of a small boat going into the inlet shouted to the occupants that he would find a large boat to rescue them. After approximately two minutes, the occupants decided the boat was going to break up on the rocks and they should get out and try to reach the jetty. The water in the area was 4-6 ft (1.2-1.8 m) deep. The men got out of the boat and managed to walk and swim to the jetty with Nos. 1 and 2 assisting No. 4, who could not walk. After reaching the jetty, a Coast Guard rescue vessel came out of the inlet and stopped approximately 25 yd (22.9 m) off the jetty. The Coast Guard vessel was unable to come closer due to shallow water and high waves. The men informed the operator of the Coast Guard vessel that all of them could make it over the rocks of the jetty to safety except No. 4. A Coast Guard rescue helicopter was called and arrived at the jetty within 10 minutes.

No. 4 was taken aboard the helicopter and transported to a beach area near Pompano. The other men walked up the jetty to safety. 1 returned to the accident area the next day and discovered that his boat was resting on the bottom in an upright position. At the time of the investigation, the boat had not been recovered. Refer to Figure 2 for a sketch of the accident area.

#### 3.4 Time Sequence of Accident Events

1800	Passengers arrived at the operator's home.
1800-2000	Sat around talking and drinking beer.
2000	Departed for launch ramp.
2020	Arrived at ramp.
2020-2030	Launched boat and loaded gear aboard.
2030	Departed down ICW.
2030-2155	Troll-fished toward Hillsboro Inlet.
2155	Arrived at Inlet.
2155-2200	Cruising through Inlet at idle speed.
2200	Boat swamped and motor stopped from water intake.
2200-2205	Boat drifted to ocean side of jetty.
2205	Passenger 2 tied off boat to rocks.
2205-2207	Occupants stayed in swamped boat.
2207-2209	Occupants left boat and reached jetty.
2219	Helicopter removed No. 4 from jetty and other occupants walked up jetty to safety.

#### 4.0 VESSEL DATA

The boat had not been recovered at the time of the investigation. The following data were obtained from the operator/owner.

The boat was a fiberglass 1969 Bertram tri-hull bowrider, powered by a 1969 40 horsepower Evinrude outboard motor. The overall length was 15.5 ft (4.7 m). There was no capacity plate attached to the boat. According to the operator, the boat was in excellent condition for a 1969 model.

#### 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

It was apparent from the interview that the operator and passengers knew very little about small boat operations. They readily admitted that they exercised poor judgment in attempting to go through the inlet, particularly since they assumed the obstruction light on the radio tower was a small craft warning. The men had drunk several beers prior to launching the boat and most likely had had more beer to drink during the trip down the ICW. By the time the decision was made to go through the inlet, the men were most likely inebriated to the point that they had little concern about the danger of attempting to go through the inlet.

#### 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- Inexperience on the part of the operator is considered the major factor. The water conditions exceeded the safe operating limits for this type boat and the operator was unable to determine this until it was too late.
- Alcohol is considered a contributing factor. The men had most likely consumed enough alcohol to affect their judgment and their ability to react properly to a dangerous situation.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

According to the estimated weight in the boat at the time of the accident, the boat was not overloaded. The load distribution was such that the boat was probably running essentially in a level attitude at idle speed. The tide was -0.3 ft (-0.09 m) at the time of the accident, consequently there was very little current or current induced waves. Rough waters in the inlet were caused by wind induced waves. The wind was from the southwest which created a sharp sheer line across the mouth of the inlet. The sheltered water on the inside of the inlet was relatively calm, while the exposed water beyond the mouth of the inlet was very rough. The transition distance from calm to rough water was most likely very short. When the boat went beyond the mouth of the inlet, waves started to break over the starboard stern completely swamping the boat. Wind and wave action causes the boat to drift to the ocean side of the north jetty. Apparently the boat had an insufficient amount or no flotation material installed because the boat eventually completely submerged. The boat probably floated due to entrapped air in the inner hull. When the air escaped, the boat sank.

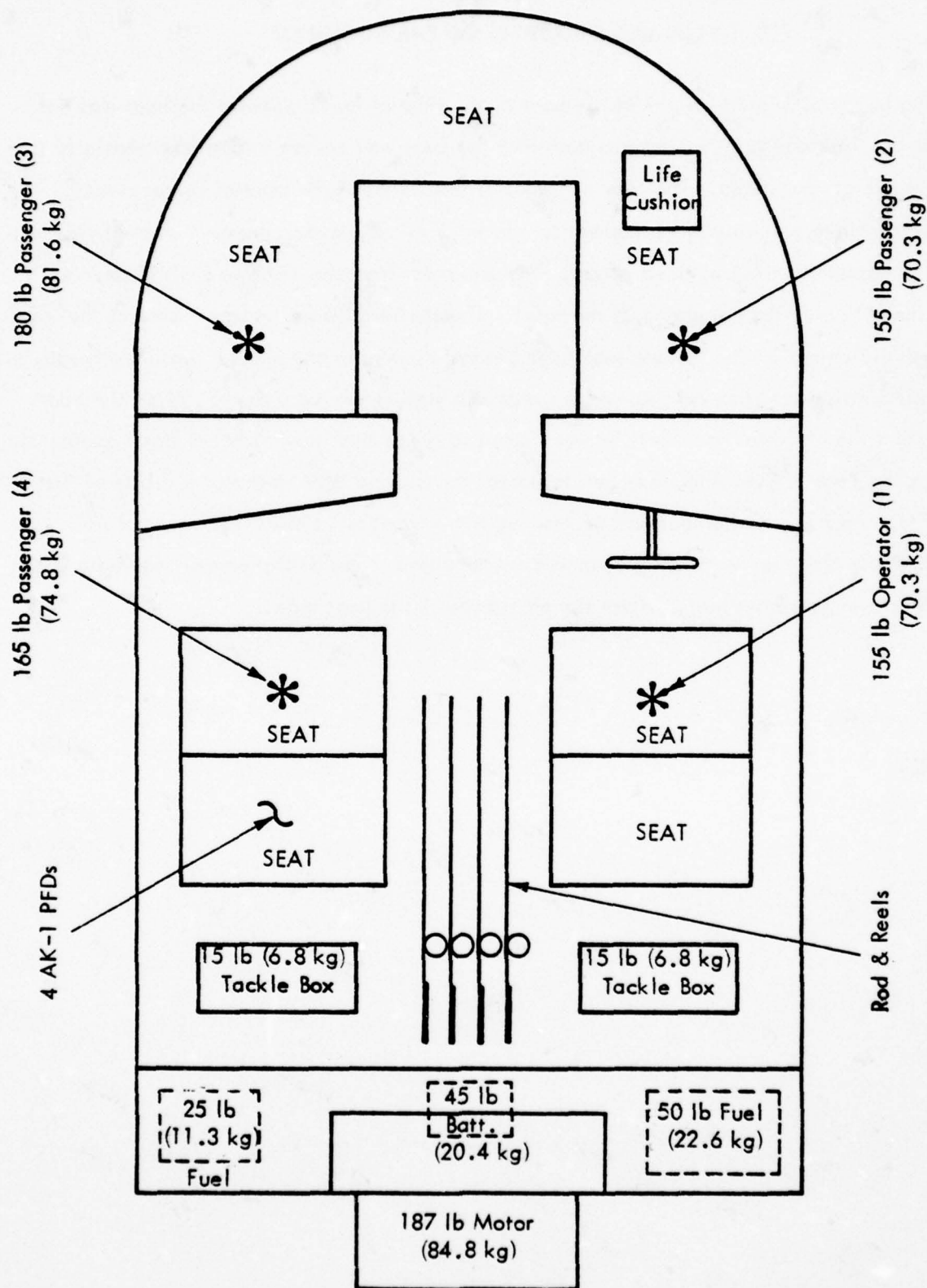


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

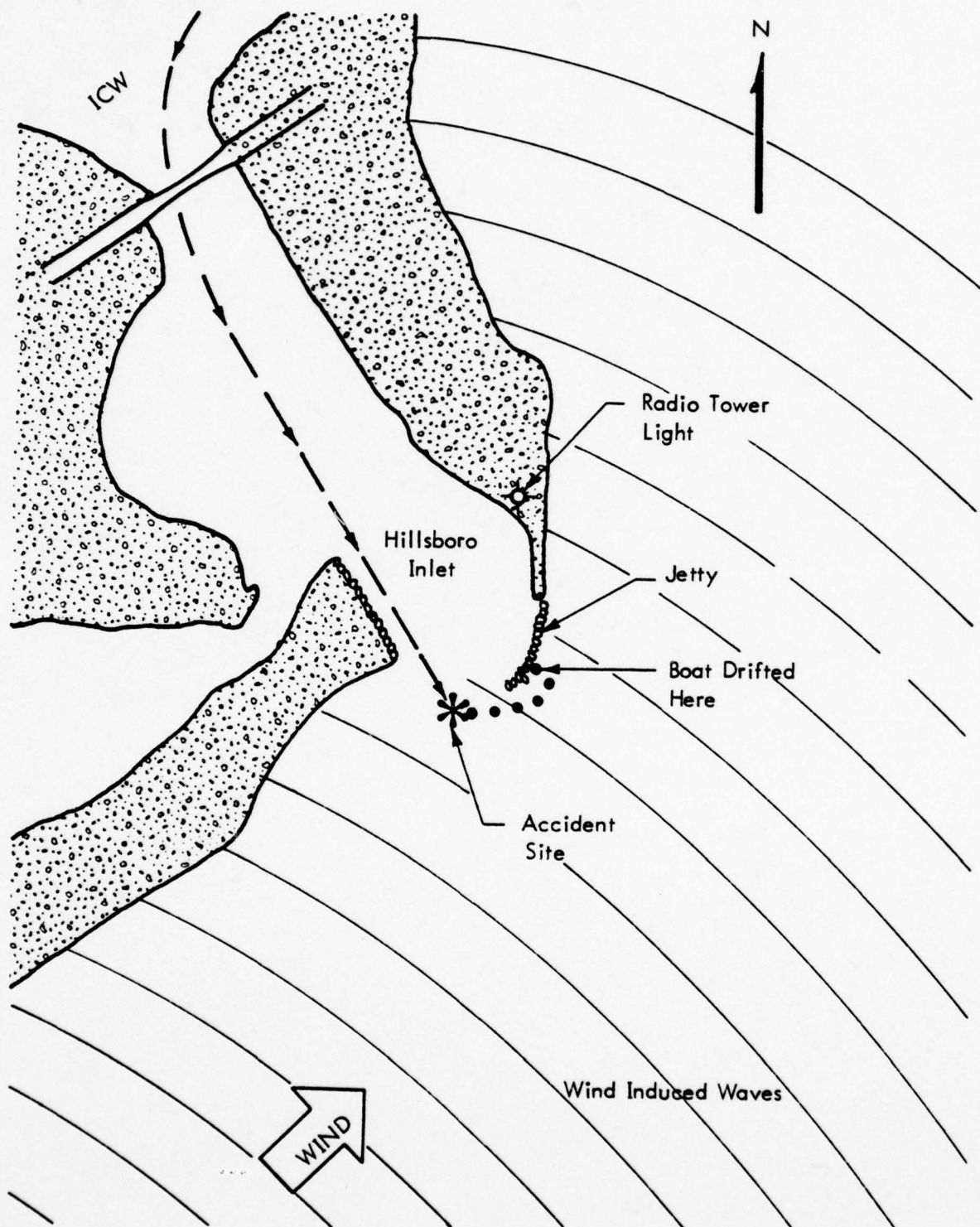


FIGURE 2. SKETCH OF ACCIDENT AREA

X-9/X-10

337

338X

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: January 28, 1977

Date of Accident: January 24, 1977

Investigation: Capsizing/Swamping No. 76-25

### SUMMARY — WYLE ACCIDENT NO. 77-22

The accident reported herein involved a 16.5 ft (5 m) v-hull runabout powered by a 55 hp outboard motor. The type of accident was a swamping with a subsequent capsizing of the boat, resulting in no injured or fatalities.

At approximately 1300 on January 24, 1977, three adult males were troll-fishing near Jupiter Inlet in southeastern Florida. The boat started across a shallow sand bar area where 3 to 5 ft (0.9 to 1.5 m) ground swells were being generated. A wave hit the boat broadside, violently rocking the boat and causing one of the passengers to fall overboard. The other passenger, seated on the port side in a wooden frame chair not secured to the boat, was thrown across the boat into the operator. As the chair and passenger were thrown across the boat, the chair hit the ignition key turning it to the off position and breaking it off flush with the ignition. The operator could not turn the key to re-start the motor. The boat was quickly swamped over the stern. After the boat filled with water, it rolled slowly to starboard until it was in an upside-down, near level attitude. The passenger that had been thrown out held to a wooden bench seat that had also been thrown out. The operator and other passenger held to the cap-sized boat. The three men were rescued by nearby pleasure boats in the area. The boat was towed to a nearby pier by one of the small boats.

Y-1

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## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Boating Instruction	PFDs Used/Worn	
							Before	After
1 Operator	M	87	200 lb 90.7 kg	Good	> 500 hr	None	No	No
2 Passenger	M	62	165 lb 74.8 kg	None	> 100 hr	None	No	No
3 Passenger	M	64	200 lb 90.7 kg	Good	< 25 hr	None	No	No

### 1.1 Owner/Operator

His formal education consisted of grade school and he was a retired machinist. His mental alertness and physical ability were considerably above average for his age. He had owned and operated small boats all his adult life and it was apparent from the interview that he was an experienced boater. His permanent residence was in Michigan, but since retiring, he and his wife had spent the winter months in Florida. He had fished in the accident area numerous times and was very familiar with the area. He assumed the responsibility for the accident since he had considerably more boating experience than the other men. He stated that he exercised poor judgment in maneuvering the boat too close to the sand bar.

### 1.2 Passenger (2)

He was a college graduate and a retired banking executive. He seemed to be of average intelligence, but below average physical condition for his age. The majority of his boating experience had been in his 12 ft (3.7 m) flatbottom boat in inland lakes and rivers. He had been on numerous fishing trips with the operator in the ICW. He was also a resident of Michigan and spent the winter months in Florida.

### 1.3 Passenger (3)

His formal education consisted of grade school and he was a retired auto mechanic. He seemed to be of average intelligence and physical condition for his age. He had very little experience in operating a boat and had never owned a boat. He had been on numerous fishing trips with the operator in the ICW and the ocean.

## 2.0 ENVIRONMENT

The sky was clear and the visibility was good. The wind was from the northeast at 7 to 14 mph (11.3 to 22.5 kph). The ocean was relatively calm except for 3 to 5 ft (0.9 to 1.5 m) ground swells in the shallow sand bar area. The estimated air temperature was 70°F (21°C) and the estimated water temperature was 80°F (15.6°C). The water depth in the accident area ranged from 5 to 14 ft (1.5 to 4.3 m).

## 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

### 3.1 Pre-Accident

The three men involved in the accident lived in the same trailer park and had been friends for a number of years. They had planned the fishing trip several days prior to the accident date. On the day of the accident, the two passengers came over to the operator's home at around 0645. The fishing gear was loaded aboard the boat, the boat/trailer connected to the operator's automobile and the men departed for the marina/launch ramp approximately 30 miles (48.3 km) away about 0700. They arrived at the marina by 0745, launched the boat and departed for a fishing area five miles (8 km) up the ICW at 0800. They troll-fished on the way up the ICW arriving at the fishing area at approximately 0900. They drift-fished until about 1030 without catching any fish. It was decided to move to the ocean to see if fishing was any better. They traveled back down the ICW to Jupiter Inlet, out the inlet, then approximately one mile (1.6 km) north and 1/4 mile (0.4 km) off shore. They drift-fished in this area until around 1200. The men had caught no fish and decided to move to a different location. The operator saw two commercial fishing vessels located south of Jupiter Inlet. He told the passengers that the commercial vessels had electronic fish locating devices and the fishing would probably be good if they moved to the area of these vessels. They headed back toward the inlet at idle speed with the passengers troll-fishing. The operator maintained a course parallel and approximately 200 yd (182.9 m) off shore. The ocean was relatively calm and the wind was light. Passenger (2) was seated on the port side adjacent to the helm seat with his seat facing aft. Passenger (3) was seated facing aft on a bench seat/storage chest located behind the helm seat. As the boat approached the inlet, the operator noticed that ground swells were being generated

on the shallow sand bar area directly ahead. He elected to keep a straight course and go across the sand bar because if he made a sharp turn to avoid the sand bar, the fishing lines trailing behind the boat could become caught in the propeller. As the boat entered the shallow area, the operator noticed that the ground swells were much larger than they appeared earlier.

### 3.2 Accident

People and gear aboard were as shown in Figure 1 and the weather as noted in Section 2.0.

Before the operator could react or warn the passengers of the rough water, a swell hit the boat broadside causing the boat to roll violently. The roll action caused Passenger (3) and the seat he was on to be thrown out of the boat over the starboard side. Passenger (2) and his seat were thrown across the boat into the operator. The back of Passenger (2)'s seat impacted the ignition key, turning it to the off position and breaking it off flush with the ignition switch. The operator attempted to turn the ignition to the start position, but was unsuccessful. The boat drifted stern first into the swells and was swamped over the stern within a 30 second period. The boat then rolled slowly to starboard until it was in an upside-down, bow-high position. The two men maintained contact with the boat by holding to the top of the windshield frame, pulling themselves to the port side as the boat rolled. They stayed with the capsized boat by holding to the forward section of the port hand rail which was above the water line.

### 3.3 Post Accident

There were numerous other small boats in the immediate vicinity at the time of the accident. Within two minutes after the capsizing, one of the small open boats came to the scene and took Passenger (3) aboard. Shortly thereafter another small open boat took the operator and Passenger (2) aboard. The three men were taken to the marina where the boat had been launched. Passenger (2) was checked by a mobile medical unit and released. The involved boat was towed to the marina by an unknown vessel. Refer to Figure 2 for sketch of the accident area.

### 3.4 Time Sequence of Accident Events

0645	Passengers arrived at operator's home.
0700	Departed for Marina.
0745	Arrived at Marina and launched boat.
0800	Departed marina for fishing area.
0900	Arrived at fishing area on ICW.
0900-1030	Drift-fished.
1030	Departed for second fishing area.
1100	Arrived at fishing location in ocean.
1100-1200	Drift-fished.
1200	Headed south toward commercial vessels.
1215	Ground swells on sand bar hit boat throwing Passenger (3) out of boat and throwing Passenger (2) across boat into operator. Ignition key broken off by chair back.
1215-1217	Boat turned stern first into ground swells, swamped, then capsized.
1215-1219	Operator and Passenger (2) held to boat, Passenger (3) held to seat that had been thrown out of boat.
1219	Passenger (3) rescued by small boat.
1220	Operator and Passenger (2) rescued by small boat.
1220	Occupants transported to Marina.

### 4.0 VESSEL DATA

The boat was a 16.5 ft (5 m) 1962 model Seabird runabout powered by a 1969 model 55 hp Johnson outboard motor. It was a v-hull of fiberglass construction. The original seats had been replaced with re-enforced lawn chairs. The seats were not anchored to the deck. There was no capacity plate attached to the boat. The following additional information was obtained during examination of the boat:

- Maximum Beam at Gunwale - 7 ft (2.1 m)
- Maximum Transom Width - 6 ft (1.8 m)
- Depth Amidships - 25 in. (0.6 m)
- Transom Height - 22 in. (0.56 m)
- Bilge Construction - Completely decked
- Type Throttle - Single level Johnson

The boat appeared to be in good condition for its age and no evidence of major damage resulting from the accident could be found. Refer to Figures 3 - 6 for overall boat views.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator had owned this boat for nine years and had averaged taking it out on fishing trips at least once every two weeks during this period. He stated that he had been in much rougher water than the ground swells on the sand bar. Most likely he decided to traverse the rough water rather than go around because he was confident the boat could take the swells safely. The men seemed to have deep religious convictions and voiced a strong opposition to drinking alcohol. Therefore, it is the opinion of the investigators that no alcohol was consumed by the men on the day of the accident.

## 6.0 PROBABLE CAUSE OF ACCIDENT

- The water conditions in the accident area exceeded the safe operating limits of the boat.
- Overconfidence on the part of the operator. Operating his boat in rough water in the past caused him to assume that the boat could safely cross the rough water in the sand bar area.
- Motor stoppage and loss of directional control. It is very likely that the accident would not have occurred had the operator been able to maintain directional control.
- Passenger unawareness of hazardous waters. The passengers were facing aft and were not aware of the sudden change in water conditions. They could have probably maintained their positions in the boat if they had known of the rough water, which would have prevented the chair impact with ignition key that stopped the motor.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

According to the estimated weight in the boat at the time of the accident, the boat was not overloaded. Wave action caused the boat to roll violently which caused the unsuspecting passengers to lose their balance. Passenger (2) was thrown across the passenger compartment with the back of his chair impacting the ignition key, turning off the motor. When the motor abruptly stopped and directional control was lost, the boat drifted stern first into the wind and waves. The wave heights were sufficient to easily break over the transom into the boat. Flotation material in the inner hull caused the boat to capsize when flooded. Placement of the flotation material also caused the boat to float in a stable, inverted attitude.

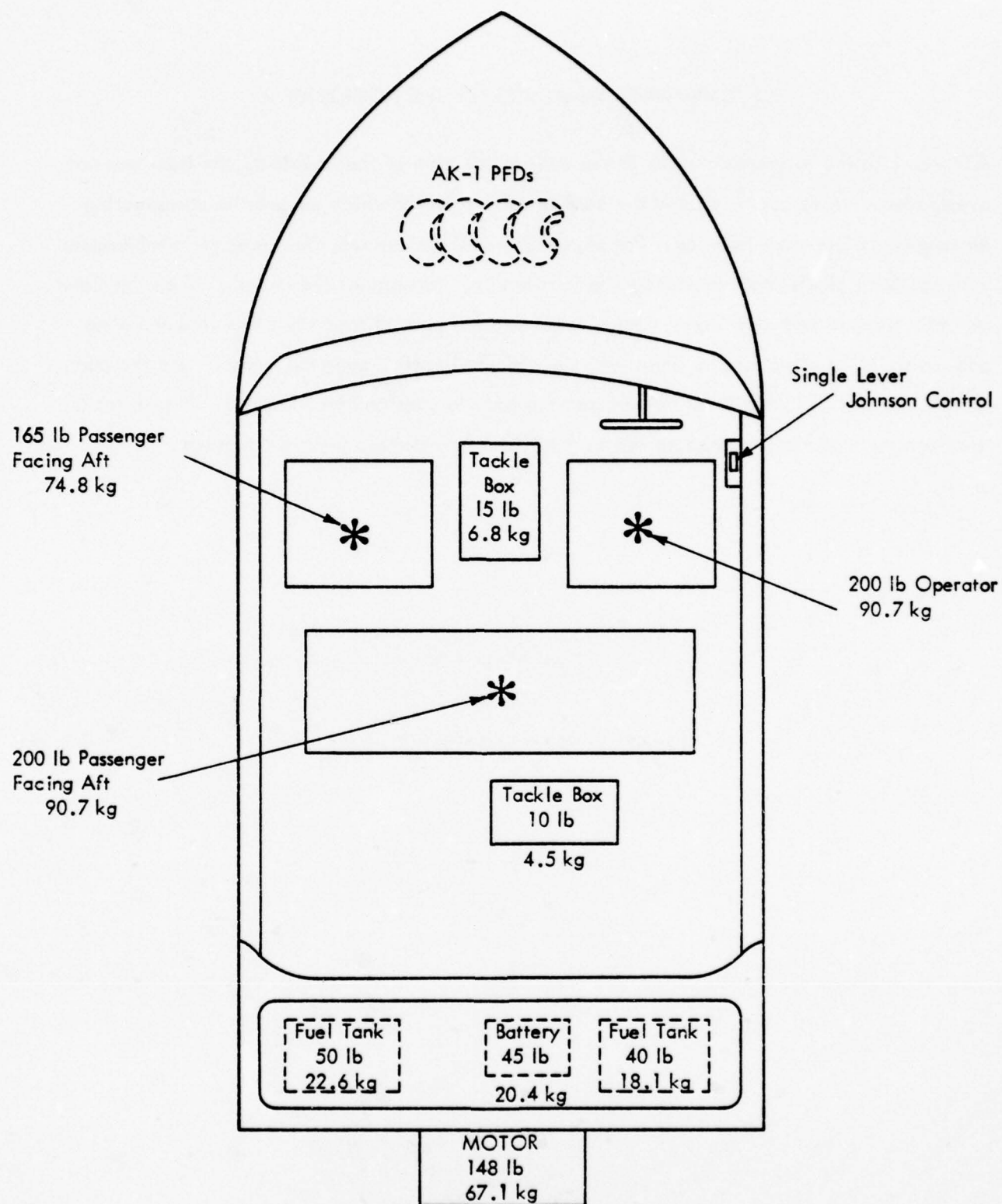


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

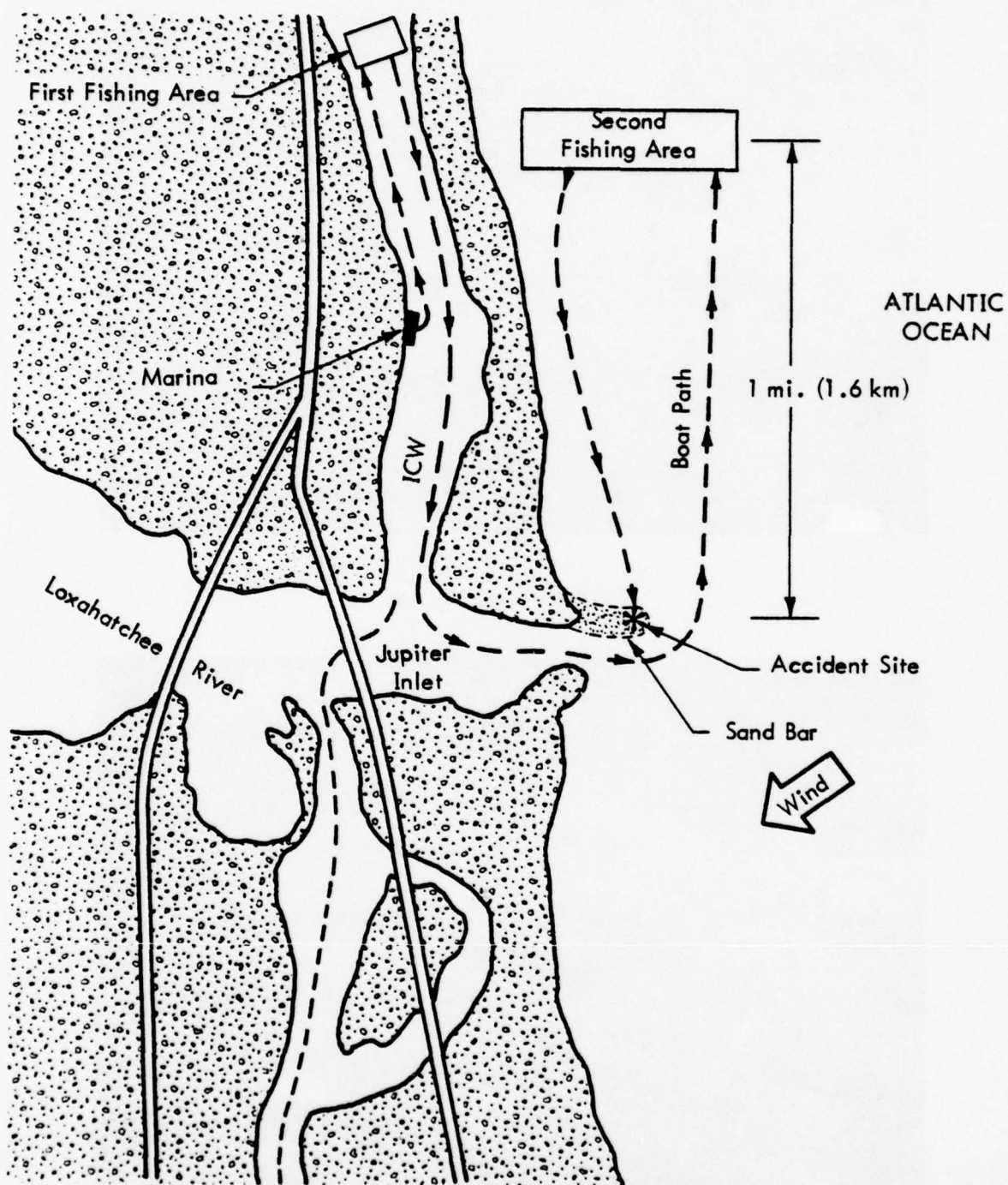


FIGURE 2. SKETCH OF ACCIDENT AREA



FIGURE 3. BOW VIEW



FIGURE 4. STERN VIEW

Y-10

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FIGURE 5. STARBOARD VIEW

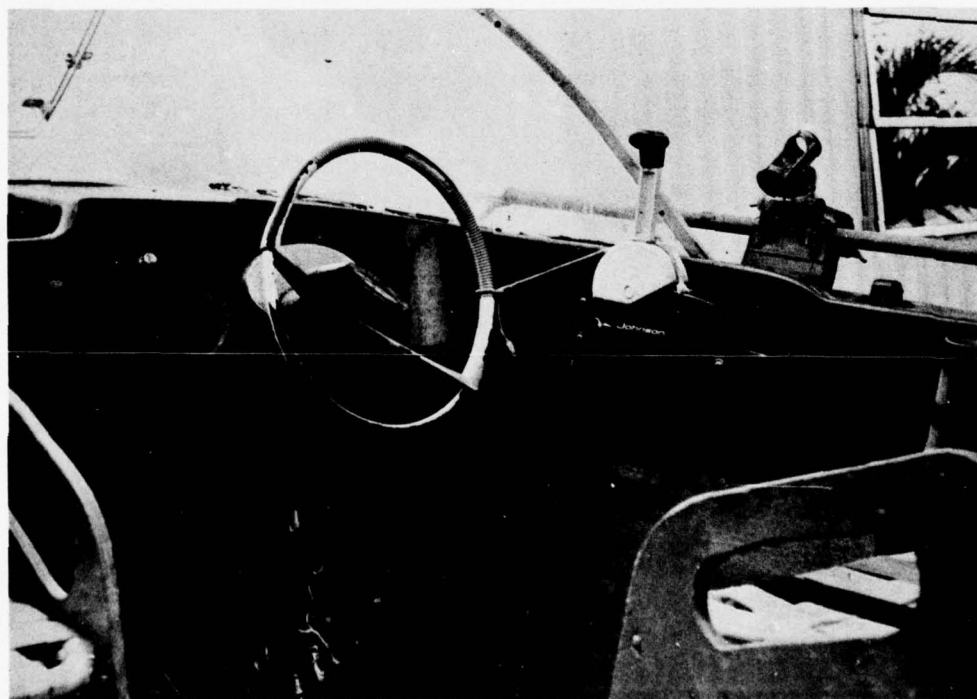


FIGURE 6. HELM STATION

Y-11/12

349  
39X

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: 20 February 1977

Date of Accident: 29 January 1977

Investigation: Capsizing/Swamping No. 76-26

### SUMMARY — WYLE ACCIDENT NO. 77-25

The accident reported herein involved a 15 ft 2 in. (4.6 m) bowrider powered by a 65 horsepower outboard motor. The type accident was a swamping with a subsequent capsizing, resulting in no injuries or fatalities.

At approximately 1400 on January 29, 1977 a family group consisting of five adults and three children were returning from a fishing trip in Little Lake Worth near Lake Park, Florida. The party was headed down the Intercoastal Waterway at 5 to 7 mph (8 - 11.3 kph) toward the marina where the boat had been launched about three hours earlier. Two large commercial fishing vessels were sighted coming up the center of the ICW. The operator of the boat maneuvered the involved boat near shore to avoid the wake of the large vessels. He turned the boat bow-on toward the oncoming waves. As the wake approached, the waves seemed to combine with wind waves and increase in amplitude. The boat rode over the first wave, then bow-first into the trough. The next wave broke over the bow completely flooding the boat. Succeeding waves over the bow completely swamped the boat. The boat capsized to starboard coming to rest in an upside-down, near level attitude. The occupants held to the boat until it completely submerged. All the occupants were rescued by a Sheriff's Patrol rescue vessel. The boat was recovered by a local salvage firm.

## 1.0 BOAT OCCUPANT DATA

Occupant	Sex	Age	Weight	Swimming Ability	Boating Experience	Formal Boating Instruction	PFDs Worn/Used Before	After*
1 Operator	M	57	150 lb 68.0 kg	Good	> 500 hr	USCG Aux	No	No
2 Passenger	M	53	150 lb 68.0 kg	Good	> 500 hr	USCG Aux	No	No
3 Passenger	F	49	140 lb 63.5 kg	Fair	< 5 hr	None	No	No
4 Passenger	F	25	130 lb 59.0 kg	Good	< 5 hr	None	No	No
5 Passenger	M	25	140 lb 63.5 kg	Good	< 5 hr	None	No	No
6 Passenger	M	4	40 lb 18.1 kg	Fair	None	None	No	No
7 Passenger	F	6	50 lb 22.6 kg	Fair	None	None	No	No
8 Passenger	F	1.5	25 lb 11.3 kg	None	None	None	No	No

### 1.1 Operator/Owner

The operator had a seventh grade education and was employed as a carpenter. He seemed to be of average intelligence and physical ability. He had owned and operated small boats for the past 30 years and seemed to possess at least an average knowledge concerning their operation. He was very familiar with the water in the accident area and had fished there in the involved boat numerous times. He had completed two boating safety courses by the Coast Guard Auxiliary during the past 10 years.

### 1.2 Passenger (2)

He had completed the eighth grade and was also employed as a carpenter. He seemed to be of average intelligence and physical ability. He was very familiar with the water in the accident area and had fished there many times. His boating experience and knowledge of small boat operation was very similar to the operator's. He had attended the two boating safety courses with the operator.

\* Some of the occupants held to life cushions after the boat capsized. The number of occupants that used cushions could not be determined.

### 1.3 Passengers (3) - (8)

These passengers were inexperienced boaters. Their experience was limited to an occasional fishing trip usually as passengers and not as operators. According to the operator, these passengers were of normal intelligence and physical ability for their ages.

### 2.0 ENVIRONMENT

The sky was obscured and the visibility was estimated at six miles (9.6 km). The wind was from the northeast at approximately 10 mph (16.1 kph) at the beginning of the trip. At the time of the accident, the wind velocity had increased to 15 mph (24.1 kph) with peak gusts to 25 mph (40.2 kph). The estimated air temperature was 60°F (21°C). The water depth in the accident area was approximately 14 ft (4.3 m).

### 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

#### 3.1 Pre-Accident

On the day of the accident a number of the owner/operator's relatives and friends had gathered at his home during the morning. At approximately 1000, the operator and some of the group decided to go on a fishing trip. The party was to include three adult males, two adult females, one male child and two female children. The boat was outside on a trailer at the operator's home in a bow high attitude with the inner plug and transom plug removed. The boat/trailer was connected to the operator's van, the fishing gear and PFDs loaded on board the boat and the party departed for the launch ramp at Lake Park Marina at 1045. They arrived at the ramp about 10 minutes later, launched the boat and departed for a fishing area in Little Lake Worth about 3 miles (4.8 km) up the ICW. The water was choppy and the operator ran the boat at plane speed (13 to 15 mph [20.9 to 24.1 kph]) to give his passengers a more comfortable ride. The party arrived at the fishing area in Little Lake Worth at approximately 1115. They drifted in the lake for about 2-1/2 hours. No fish had been caught and the party decided to go to a different fishing area down the ICW near Lake Worth Inlet. Upon leaving the sheltered area of the lake, the operator noticed that the wind velocity had increased and the water condition was much worse. It was necessary for him to run the boat at a slow speed (5 to 7 mph [8 to 11.3 kph]) due to the rough water. After traveling approximately 1-1/2 miles (2.4 km), the operator's wife (passenger 3) became frightened and told him she wanted to return to the marina. He then realized that the water conditions were too rough for his boat and decided to go directly to the marina. At this point he noticed two large commercial fishing vessels coming up the center of the ICW. He maneuvered the boat within 50 yards (45.7 m) of the east shore to avoid the wake of the large vessels. As the first vessel passed, he could see that a large wake was being generated and turned his boat bow-on into the oncoming waves. He turned on the bilge pump to evacuate any water that might splash into the boat.

### 3.2 Accident

People and gear were as shown in Figure 1 and the weather as noted in Section 2.0.

As the waves approached, they seemed to combine with wind waves and increase in height. The boat rode over the crest of the first wave, then bow-first into the trough. The second wave broke over the bow, completely swamping the forward passenger compartment. The next two waves completely swamped the boat over the bow. The operator had been told when he purchased the boat that it was equipped with flotation and would not sink. He instructed the passengers to stay in the boat and they would be safe.

Shortly after filling with water, the boat started a slow roll to starboard. It continued to roll until it was in an upside-down bow-high attitude. As the boat rolled, the occupants floated out over the starboard side. Some of the occupants grabbed life cushions that were floating in the stern section.

### 3.3 Post Accident

All of the occupants stayed in a group, with the adults holding to the children. The operator told the passengers to hold to the boat. Leaving the boat to swim ashore was not discussed. The boat started to sink and within five minutes only the keel was above water. At this point a Sheriff's Patrol rescue vessel had spotted the capsized boat and had come alongside. All the occupants were taken aboard the rescue vessel. After all occupants were aboard, the operator noticed that his boat had completely submerged.

The occupants were taken approximately one mile (1.6 km) to the marina where the involved boat had been launched. The boat was recovered by a salvage firm six days after the accident. Refer to Figure 2 for a sketch of the accident area.

### 3.4 Time Sequence of Accident Events

1000	Decision was made to go on fishing trip.
1000-1045	Preparations made for trip.
1045	Left operator's home for marina.
1055	Arrived at marina launch ramp.
1055-1100	Boat launched and gear loaded aboard.
1100	Departed marina for fishing area.
1100-1115	Traveled up ICW to Little Lake Worth.
1115	Arrived at fishing area.
1115-1345	Drift-fished in lake.
1345	Departed lake for different fishing location.
1355	Decided to return to launch ramp, spotted commercial vessels coming up ICW.
1357	Wake from commercial vessel reach boat.
1357-1400	Boat swamped and capsized.
1400-1405	Occupants stayed with boat.
1405	Occupants rescued by patrol vessel.

### 4.0 VESSEL DATA

The boat was a 15 ft 2 in. 1969 model Bonito bowrider powered by a 65 hp 1972 Johnson out-board motor. It was a tri-hull of fiberglass construction. The following additional information was obtained during examination of the boat:

- Maximum Horsepower - 80 (OBC plate)
- Maximum Beam Gunwale - 69 in. (1.8 m)
- Maximum Beam Chine - 54.5 in. (1.4 m)
- Maximum Transom Width - 63 in. (1.6 m)
- Depth Amidships - 22 in. (0.6 m)
- Transom Height - 19.5 in. (0.5 m)
- Portable bilge pump placed in transom well.

Very little damage resulting from the accident could be found. The boat seemed to be structurally sound, but the overall appearance was poor. It was evident that the boat had received little or no care. Refer to Figures 4 through 7 for overall boat views.

## 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator and Passenger 2 were the only occupants aboard that had a significant amount of operating experience. They had completed boating safety courses and were aware of the do's and don't's concerning safety of boat operations. However, they seemed to be the type individuals that would not be concerned about overloading, rough water or other hazardous conditions unless the situation was very evident. The operator did not consider that the water conditions were approaching the safe operating limits of his boat until his wife became frightened. He stated that he was very confident that he could safely operate his boat in the conditions that existed at the time of the accident.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- Overconfidence on the part of the operator. Operating a bowrider of this size in conditions that existed at the time of the accident would most likely be considered hazardous. The operator stated he did not consider it hazardous.
- Possible overloading. The estimated weight in the boat would indicate that the loading exceeded the maximum weight capacity (comparing this hull with similar designs tested under the compliance test program at Wyle Laboratories).
- Failure of the commercial vessel operator to minimize his wake when passing the small boat.

## 7.0 DYNAMICS/ANALYSIS OF THE ACCIDENT

According to the estimated weight in the boat at the time of the accident, the loading most likely exceeded the maximum weight capacity. Considering the fact that the boat sank rapidly, the inner hull probably contained a significant amount of water. As far as could be determined, the inner hull was air tight except for the drain hole and supposedly the drain plug was in place. If the inner hull had been dry and sealed the air volume would have been sufficient to keep the boat afloat.

The boat rode over the crest of the wave and headed bow-first into the trough. As the boat started down the wave, any water in the inner hull would flow forward, increasing the weight in the bow. When the bow reached the trough, people and water weight in the bow and forward momentum of the boat caused the bow to slice into the next wave - flooding the forward passenger compartment. The flooded bow section caused the bow freeboard to be reduced to the point that succeeding waves broke over the bow completely swamping the boat. The boat probably capsized due to movement of the occupants and entrapped air in the inner hull. When the boat capsized air pockets were most likely formed in the passenger compartment. The boat remained afloat until the roll and pitch action of the boat caused the air pockets to fill with water.

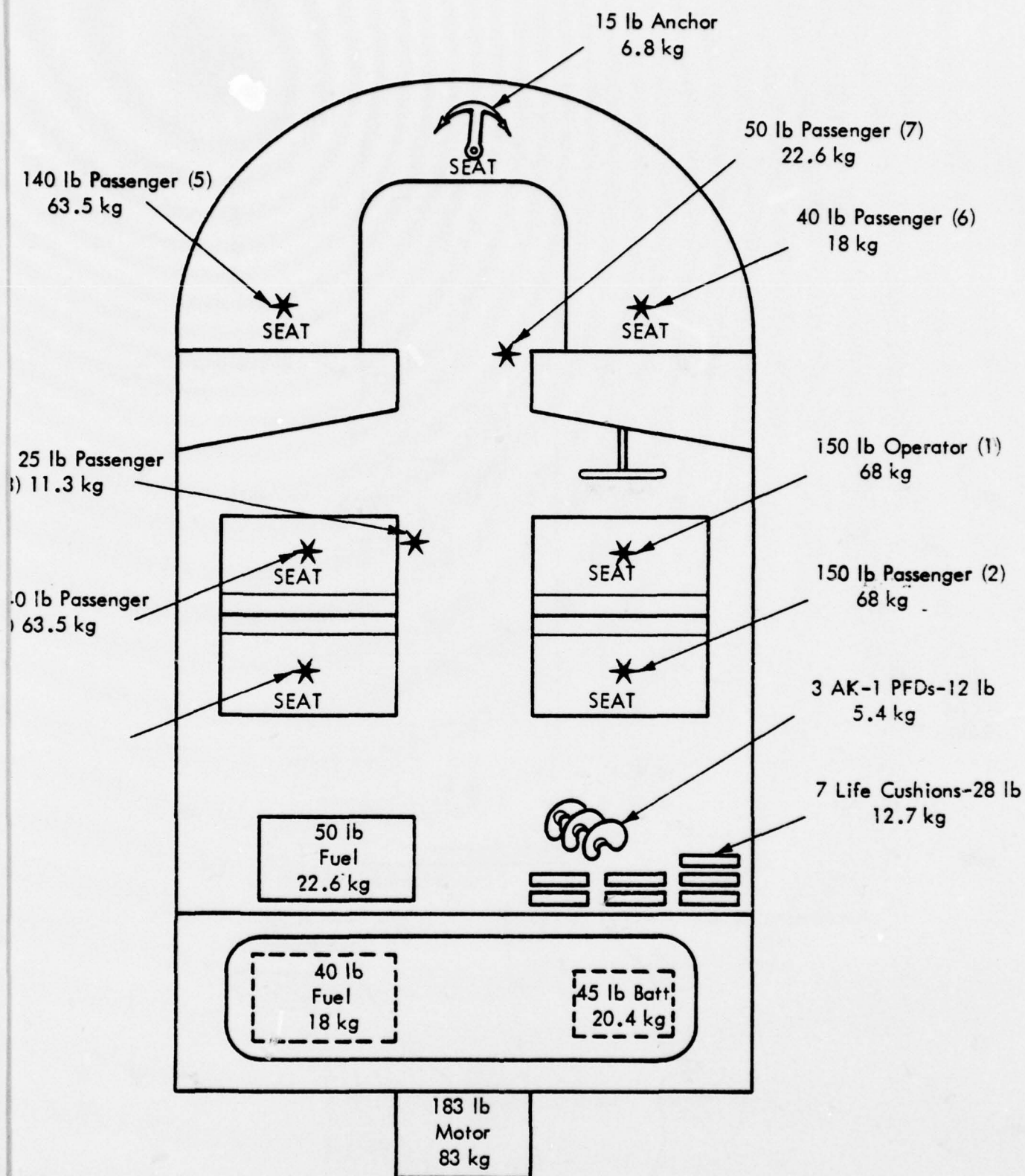


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

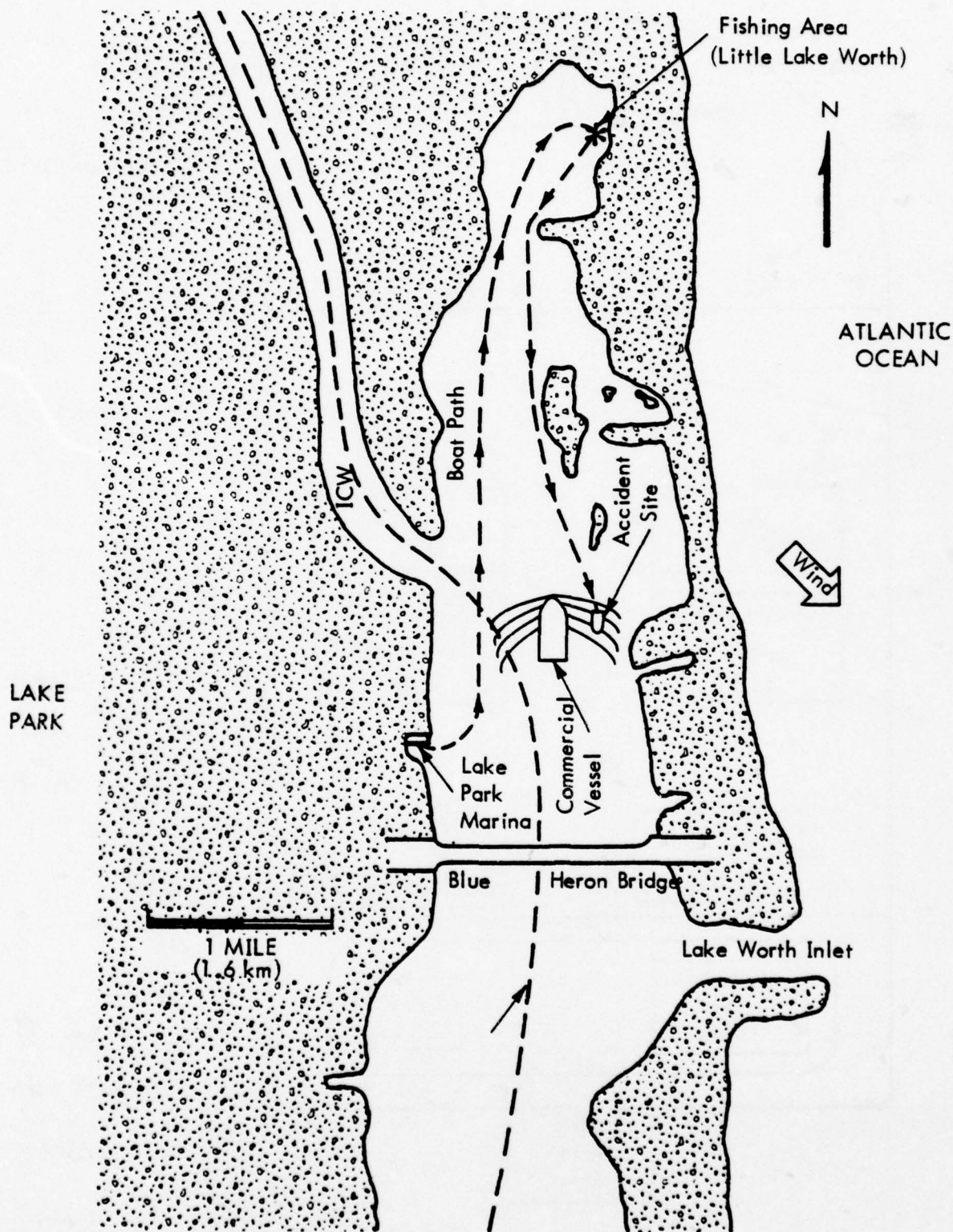


FIGURE 2: SKETCH OF ACCIDENT AREA

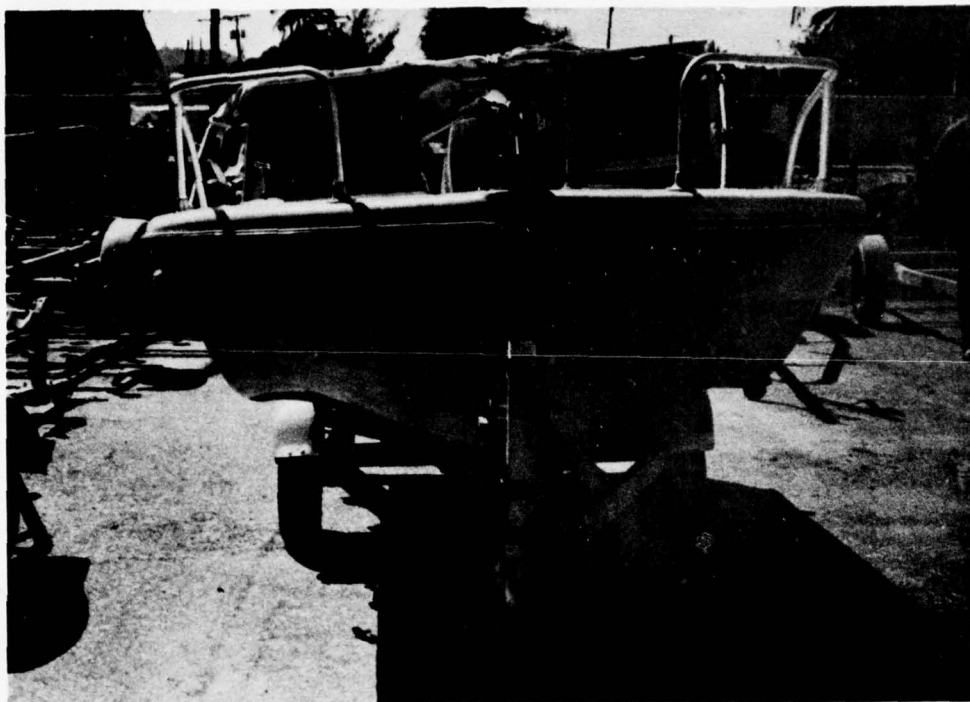


FIGURE 3. BOW VIEW



FIGURE 4. SIDE VIEW

Z-11

361

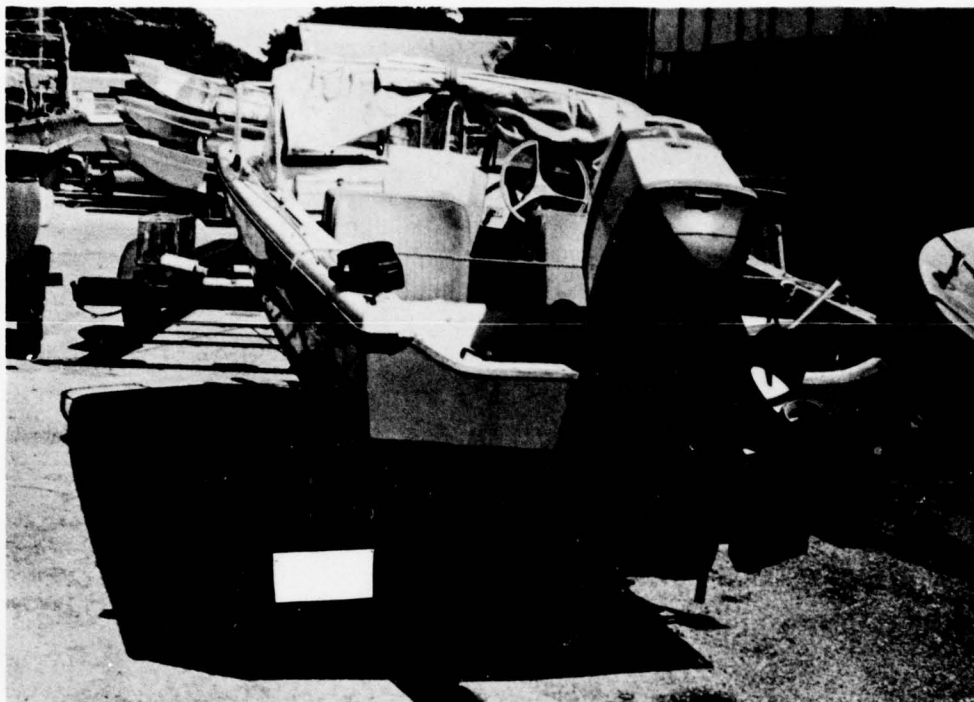


FIGURE 5. STERN VIEW

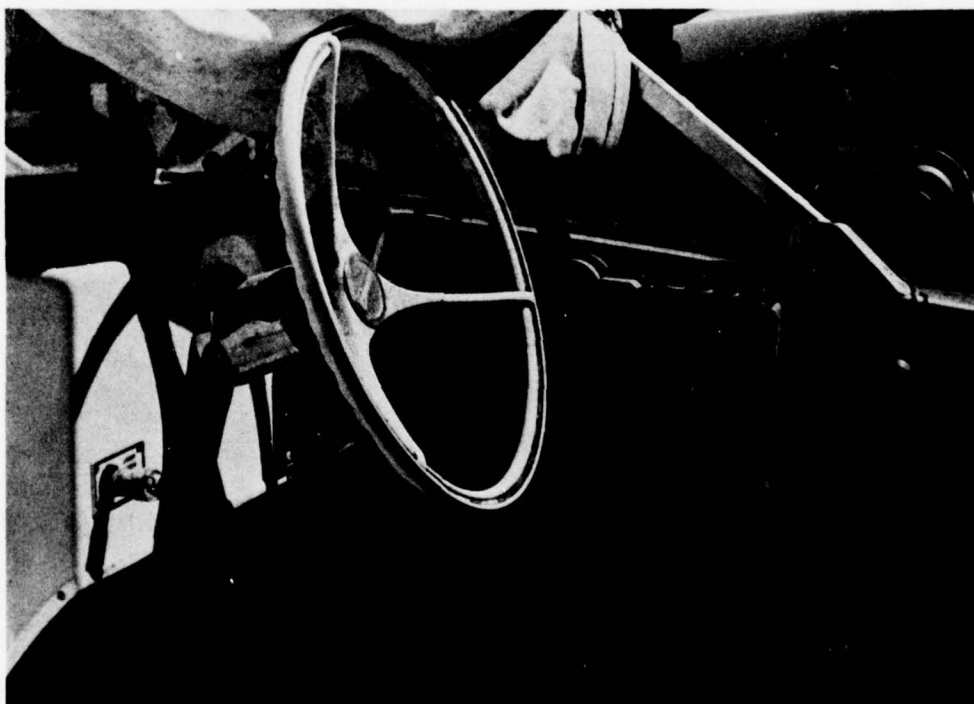


FIGURE 6. VIEW OF HELM

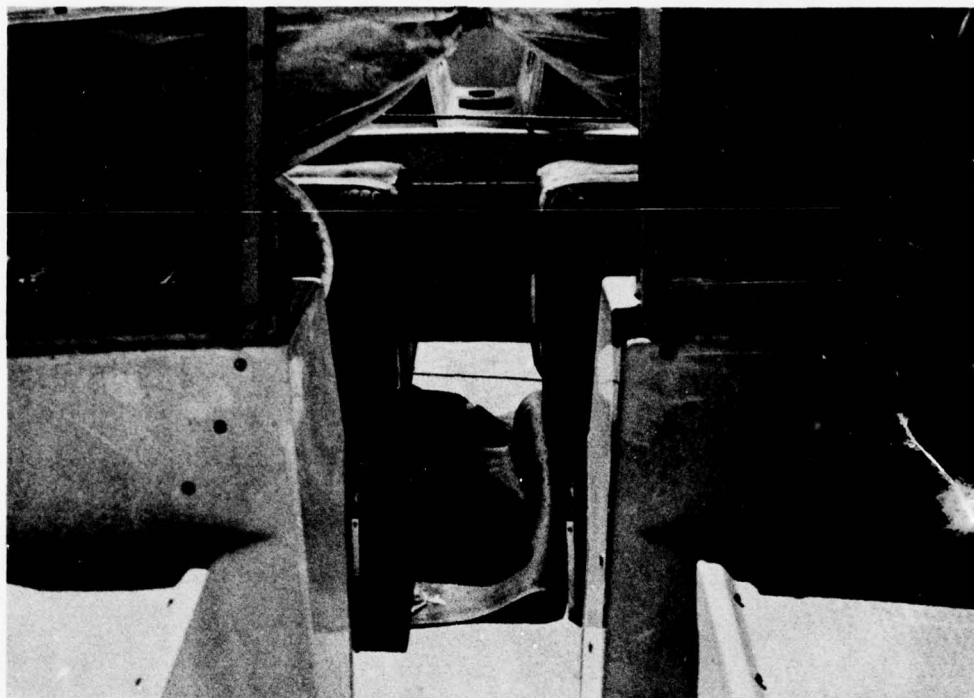


FIGURE 7. INTERIOR VIEW LOOKING AFT

Z-13/14

363  
364X

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: March 18, 1977

Date of Accident: March 6, 1977

Investigation: Capsizing/Swamping No. 76-27

### SUMMARY — WYLE ACCIDENT NO. 77-035

The accident reported herein involved an 18 ft (5.5 m) tri-hull bowrider powered by a 135 horsepower outboard motor. The type of accident was a swamping resulting in no injuries or fatalities.

At approximately 1500 on March 6, 1977, a family group of two adult males, two adult females, and a teenage boy were coming into an inlet near Miami, Florida, after a pleasure cruise in the Atlantic Ocean. The ocean was relatively calm, but the inlet was very rough with a confused wave pattern. The boat negotiated several small waves, then encountered a large wave (4-5 ft (1.2-1.5 m)). The boat rode over the crest and into the valley. The bow sliced into the next wave completely swamping the passenger compartment over the bow. The motor submerged and stopped from water intake. All the occupants grabbed AK-1 PFDs and all but one adult male jumped out of the boat. Within five minutes, the occupants in the water and the occupant that stayed in the boat were rescued by nearby pleasure boats. The boat sank to the top of the gunwales, but did not capsize. The swamped boat was towed to a nearby launch ramp where the water was evacuated.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn/Used</u>	
							<u>Before</u>	<u>After</u>
Operator	M	21	200 lb (91 kg)	Excellent	< 50 hrs	None	No	Yes
Passenger	M	43	185 lb (84 kg)	Non-Swim	< 50 hrs	None	No	Yes
Passenger	F	42	160 lb (73 kg)	Fair	None	None	No	Yes
Passenger	F	22	160 lb (73 kg)	Fair	None	None	No	Yes
Passenger	M	14	190 lb (86 kg)	Excellent	None	None	No	Yes

### 1.1 Operator

He was a high school graduate and seemed to be of average intelligence and physical ability. He was a senior life saver and was considered an excellent swimmer. He worked as a mechanic in his father's auto repair and body shop. It was apparent from the interview that he was an inexperienced boat operator and possessed very little knowledge concerning proper operating rules and procedures. All of his boating experience had been gained in the involved boat mostly in inland waters. He had operated the boat in the ocean two times prior to the day of the accident.

### 1.2 Owner (Passenger 2)

He was a high school graduate and seemed to be of average intelligence and above average physical ability for his age. He owned and operated an auto repair and body shop. All of his boating experience had been gained in the involved boat which he had owned for six months. It was apparent from the interview that he was an inexperienced operator and had little knowledge concerning proper operating rules and procedures. Most of his operating experience had been in inland waters. He had operated the boat in the ocean only a few times.

### 1.3 Passengers 3, 4, 5 and 6

These individuals seemed to be of average intelligence and physical ability. They had no boat operating experience. All of their time on a boat (less than 25 hrs) had been as passengers.

## 2.0 ENVIRONMENT

The sky was clear and the visibility excellent. The wind was from the northeast at an estimated velocity of 10 mph (16.1 kph). The water was calm in the Intercoastal Waterway and ocean, but very rough in the inlet (4-5 ft (1.2-1.5 m) waves). The estimated air temperature was 70°F (21°C) and the estimated water temperature was 65°F (18°C). The water depth in the accident area was approximately 15 ft (4.6 m).

## 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

### 3.1 Pre-Accident

At approximately 0830 on March 6, 1977, a family consisting of a man, his wife, and two sons decided to go on a pleasure cruise in Biscayne Bay near Miami Beach, Florida. The fifth occupant, wife of the oldest son, had to work until 1200 and planned to join the group at the marina at 1230. The boat/trailer was connected to the owner's automobile and the group left the owner's home for the marina approximately three miles (4.8 km) away at 0845. After arriving at the marina, the boat was launched and picnic supplies purchased and placed in a cooler aboard the boat. It had been decided that the oldest son would operate the boat on the pleasure cruise. The party left the marina at approximately 0915 and headed south toward MacArthur Causeway. They pleasure cruised in the southern end of Biscayne Bay until approximately 1215. They returned to the marina, picked up the son's wife at approximately 1230, then headed north. They pleasure cruised adjacent to Haulover Beach Park until approximately 1330. The water was calm and it was a beautiful day for pleasure riding. The two sons suggested that they go out in the ocean and cruise around on the ocean side of Miami Beach. The group agreed and they headed out through Bakers Haulover Inlet at approximately 1330. Waves in the inlet were 1-2 ft (0.3-0.6 m) high and the operator maneuvered the boat through the inlet at approximately 10 mph (16.1 kph) with no difficulty. They cruised around in the ocean until approximately 1500, occasionally stopping the motor and letting the boat drift. During the outing, the picnic supplies consisting of 12 soft drinks and snacks had been consumed by the occupants. They headed back in, and as they approached the inlet the owner noticed that the water conditions

in the inlet were much worse than when they went out. The owner told the operator that he had been told the inlet could be very treacherous and to be very cautious going through. The operator replied that he would go slow and that they should have no trouble. As they entered the inlet, the boat rode over several 1-3 ft (0.3-0.9 m) swells with a negligible amount of water splashing over the bow into the forward passenger compartment.

### 3.2 Accident

Gear and people aboard were as shown in Figure 1, and the weather as noted in Section 2.0.

The owner and operator stated that suddenly the boat seemed to be in the center of a large whirlpool with waves coming at the boat from all directions. The boat rode over the crest of a 5-6 ft (1.5-1.8 m) wave and bow first into the trough. The bow then sliced into the next wave completely swamping the forward passenger compartment. Within a period of 30 seconds, succeeding waves completely swamped the boat. The boat submerged until only the windshield was above water. Three AK-1 PFDs were stored under each set of back-to-back seats. When the boat flooded, the foam padded seats floated upward, releasing the PFDs and allowing them to surface. Each occupant grabbed a PFD immediately after the boat flooded. According to the owner, the kapok bags came out of the PFDs as soon as they were grabbed. This statement could not be verified because the PFDs had been thrown away after the accident.

### 3.3 Post-Accident

All the occupants were standing in the flooded boat. Within one minute after the accident, a small runabout came into the inlet and passed within 25 ft (7.6 m) of the swamped boat. The occupants shouted for help, but the operator of the runabout choose not to render assistance.

The operator and the 14 year old boy thought the boat was sinking and jumped overboard. The operator swam back to the boat and pulled his mother out of the boat.

Within two minutes after the accident, a large cabin cruiser that had witnessed the accident came alongside. The two boys and their mother boarded the cruiser. The owner and daughter-in-law remained in the flooded boat. Shortly after the cruiser arrived, a 19 ft (5.8 m) runabout pulled alongside opposite the cruiser. The daughter-in-law jumped out of the flooded boat and swam a few yards to the runabout where she was helped aboard. The runabout then pulled close enough to the flooded boat that the owner could climb into the runabout.

The involved boat continued to float in an upright near level attitude. The occupants were transported to a nearby dock and the involved boat was towed to the same dock by a Coast Guard Auxiliary vessel. A Coast Guard rescue vessel pumped the water out of the involved boat after it was towed to the dock. (Refer to Figure 2 for a sketch of the accident area.)

#### 3.4 Time Sequence of Accident Events

0845	-	Left owner's home for marina
0900	-	Arrived at marina
0900-0915	-	Launched boat and purchased picnic supplies
0915	-	Departed marina toward south end of Biscayne Bay
0930	-	Arrived at south end of bay
0930-1215	-	Cruised around in bay
1215	-	Headed back to marina
1230	-	Arrived at marina, picked up passenger, and departed north toward Haulover Beach Park
1245	-	Arrived at park area
1245-1330	-	Cruised around adjacent to park
1330	-	Headed through Bakers Haulover Inlet to ocean
1335	-	Arrived in ocean
1335-1500	-	Cruised around in ocean
1500	-	Headed back toward inlet
1505	-	Encountered rough water in inlet; boat swamped by wave over bow
1505-1506	-	Occupants stayed in flooded boat, shouting for help
1506	-	Two sons jumped out of boat
1507	-	Older son pulled mother out of boat
1507-1509	-	Owner and daughter-in-law stayed in boat, other occupants swam to nearby rescue boat and climbed aboard
1509-1510	-	Daughter-in-law left flooded boat, swam to second nearby rescue boat, and climbed aboard
1510-1511	-	Owner left flooded boat and climbed aboard second rescue boat

#### 4.0 VESSEL DATA

The boat was sold a few days after the accident and was not available for inspection. The following data were obtained from the owner and operator.

The boat was a fiberglass 1976 model Galaxy tri-hull bowrider powered by a 1973 135 horsepower Evinrude outboard motor. The overall length was 18 ft (5.5 m). The owner remembered the maximum horsepower on the capacity plate was 150, but did not remember the specified maximum persons or weight. According to the owner, the boat was in excellent condition. Figures 3-5 are of a similar boat which had undergone compliance tests at Wyle.

#### 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

The operator and passengers had lived in Florida only six months and were almost totally unfamiliar with the waters in the accident area. It was apparent from the interview that the occupants knew very little about small boat operations. They had not encountered rough water before and were not aware of the boat handling characteristics in rough water. The operator stated that he felt the boat was large enough to safely negotiate the inlet and was very surprised when it swamped. The owner stated that he was not sure where the boat could have made it safely through the inlet, but he felt his son (operator) was better qualified to make a go, no go, decision since he had been operating the boat all day.

## 6.0 PROBABLE CAUSE OF ACCIDENT

Inexperience on the part of the operator is considered the major factor. The water conditions in the inlet exceeded the safe operating limits for this type boat and the operator was unable to determine this until it was too late.

## 7.0 DYNAMICS/ANALYSIS OF ACCIDENT

According to the estimated weight in the boat at the time of the accident, the boat was not overloaded. The load distribution was such that the boat was most likely running in a slightly bow low attitude. The tide was outgoing at the time of the accident, consequently there were current induced waves in the inlet. The wind was from the northeast, against the current, which produced wind induced waves. The wind and current was such that the waves in the inlet were not uniform (confused). The sheltered water on the inside of the inlet was relatively calm and the water beyond the mouth of the inlet was relatively calm. The transition distance from the calm water of the ocean and the rough water in the inlet was most likely very short. When the boat went into the mouth of the inlet, the water conditions changed in a short distance from light chops to 5-6 ft (1.5-1.8 m) waves. The boat rode over the crest of a wave, then bow first into the trough. The load distribution and forward momentum of the boat caused the bow to slice into the next wave flooding the forward passenger compartment. The bow freeboard was reduced by water weight to the point that succeeding waves broke over the bow swamping the entire boat. The boat most likely stayed in an upright position after flooding because of flotation material installed in the gunwales.

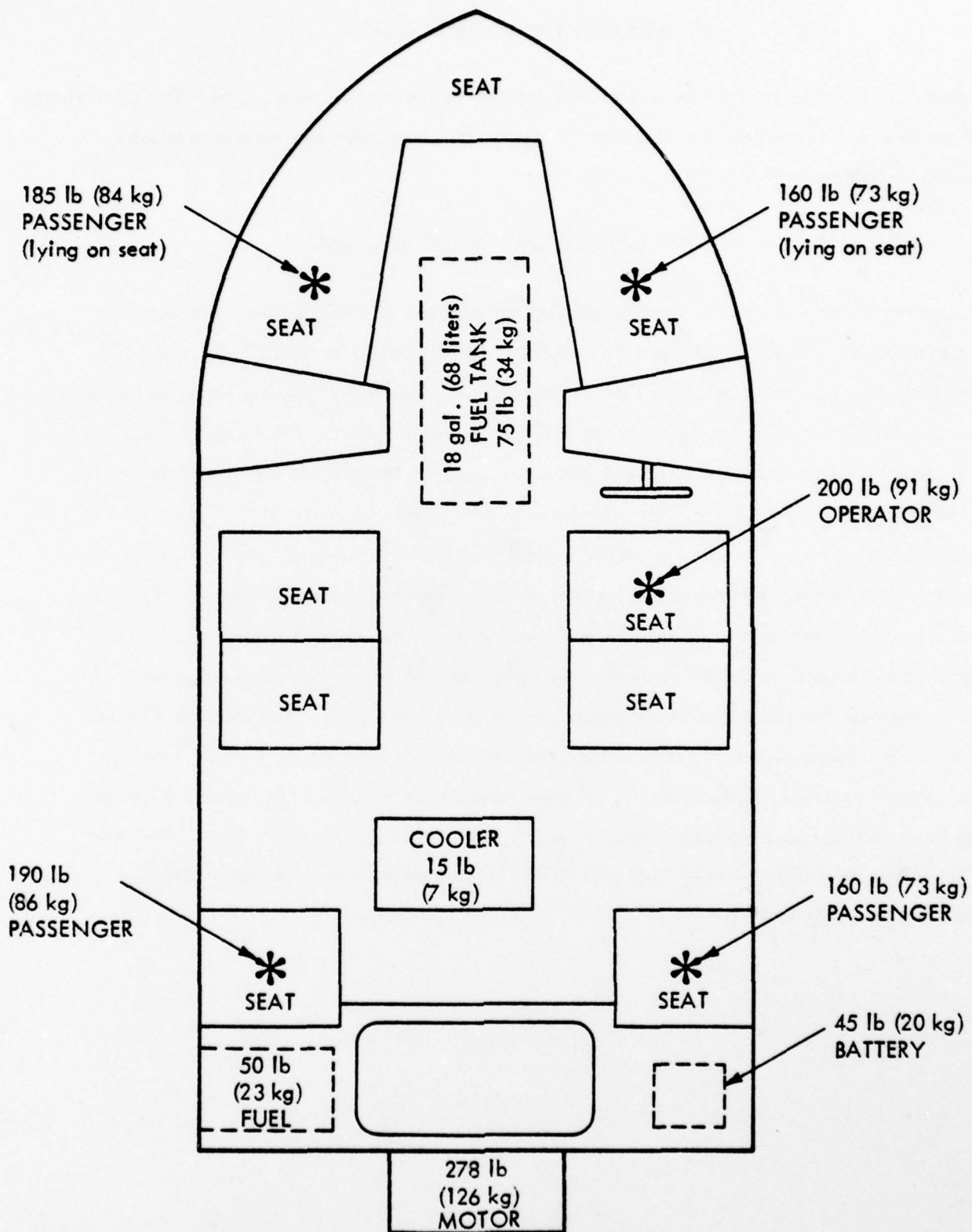


FIGURE 1. LOAD DISTRIBUTION AT TIME OF ACCIDENT

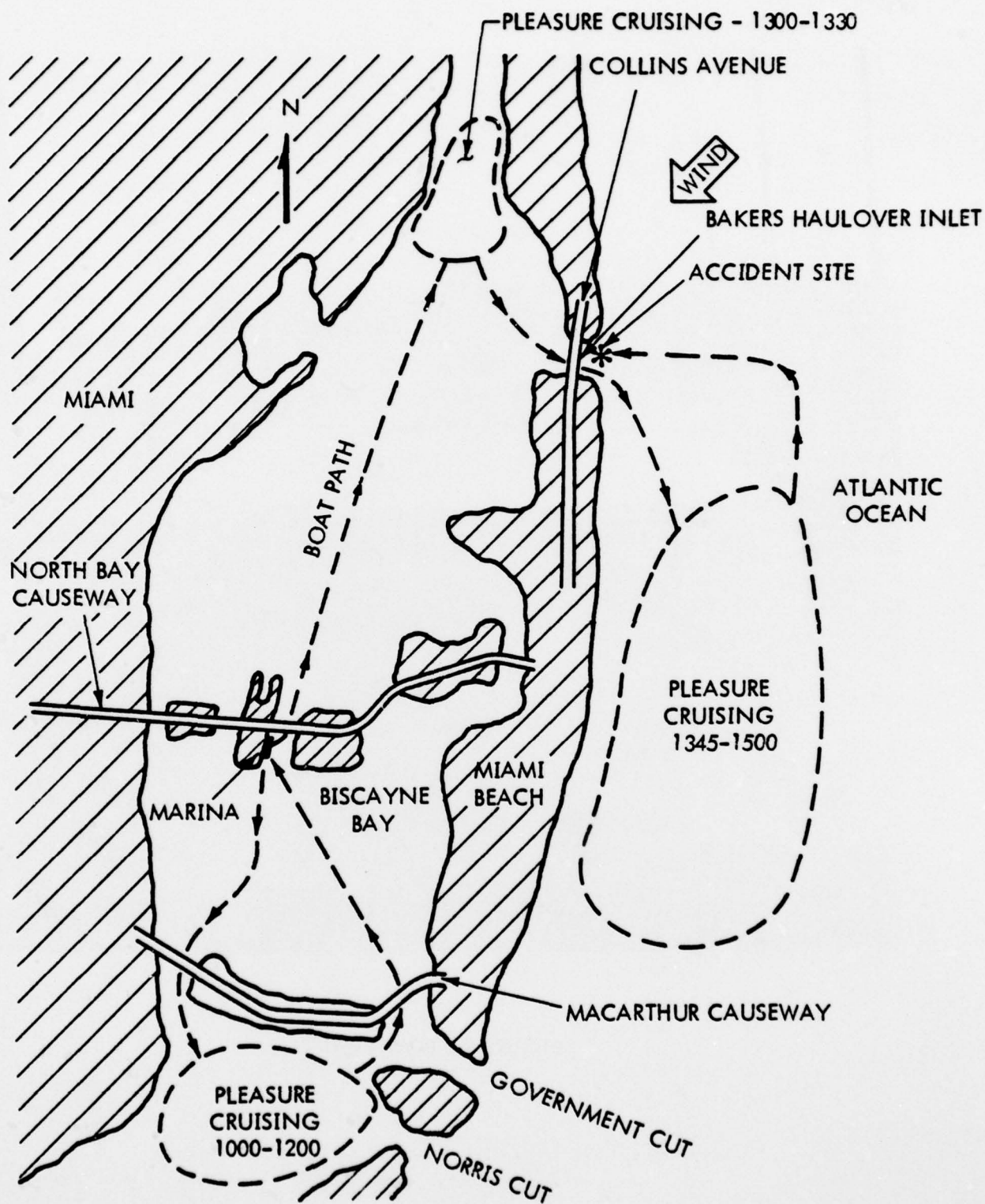


FIGURE 2. SKETCH OF ACCIDENT AREA



FIGURE 3. BOW VIEW

AA-10

374

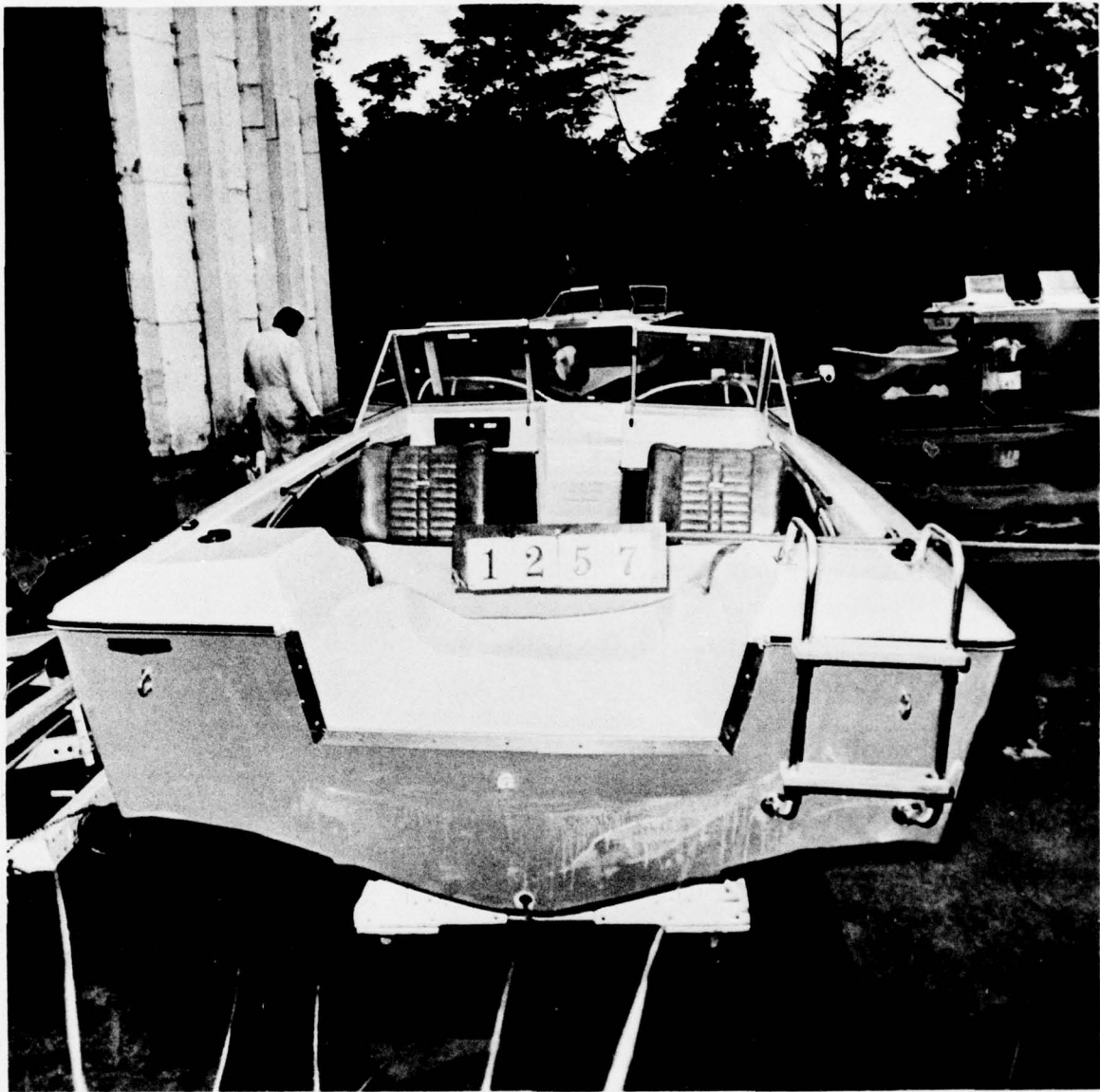


FIGURE 4. STERN VIEW

AA-11

375

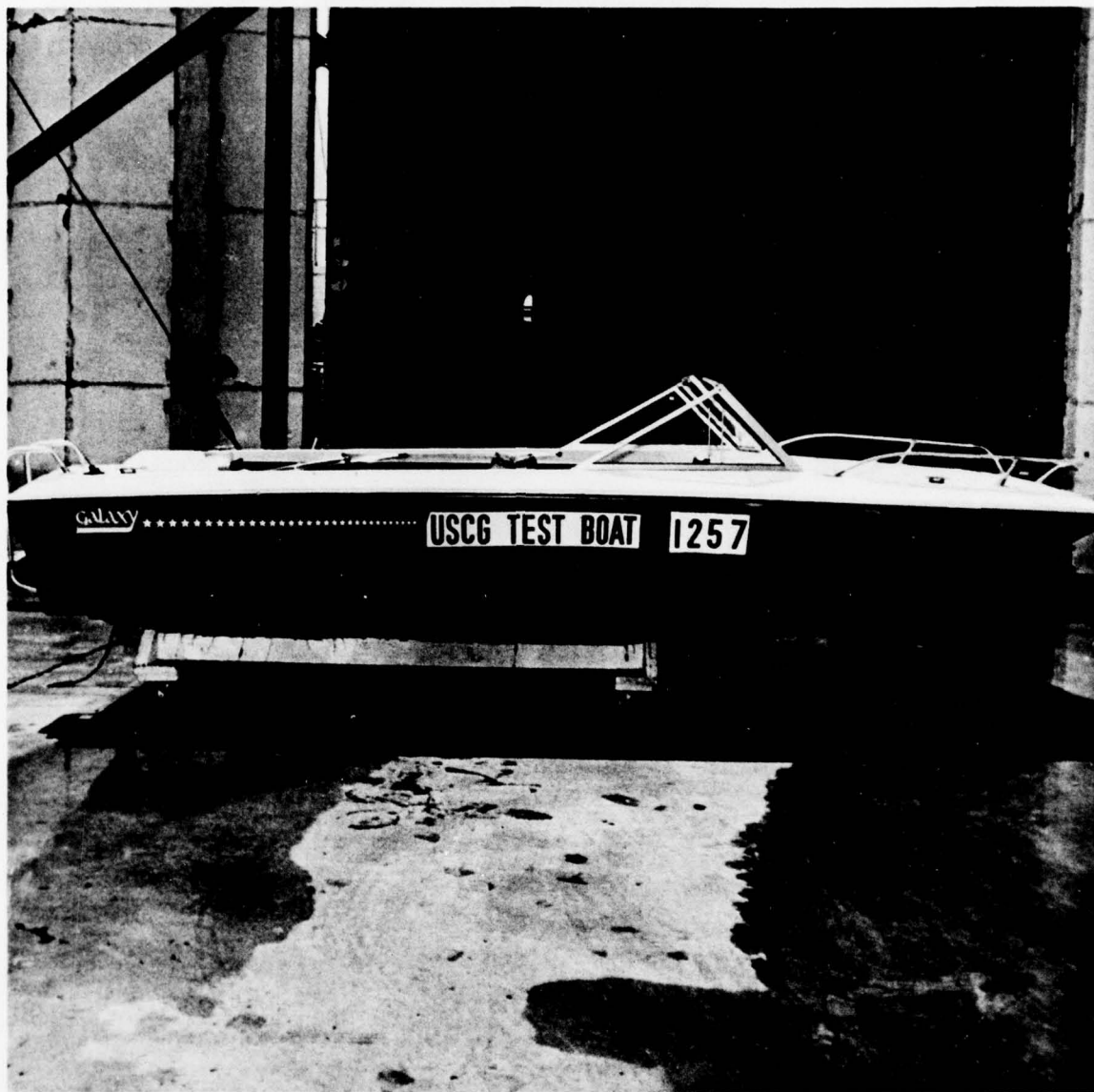


FIGURE 5. SIDE VIEW

AA-12

376

## ACCIDENT INVESTIGATION REPORT

Date of Investigation: March 20, 1977

Date of Accident: March 6, 1977

Investigation: Capsizing/Swamping No. 76-28

### SUMMARY — WYLE ACCIDENT NO. 77-036

The accident reported herein involved a 16 ft (4.9 m) fiberglass semi-V runabout powered by a 85 horsepower outboard motor. The type of accident was a swamping resulting in no injuries or fatalities.

At approximately 1600 on March 6, 1977, three adult males were drift fishing in the Gulf of Mexico approximately three miles (4.8 km) out from Clearwater, Florida. One of the passengers noticed that the stern was unusually low and water was visible in the aft third portion of the boat. The two passengers were standing in the stern section and the operator was seated at the helm amidships. The passengers suspected that the motor had caught on something, dragging the stern down. The passengers informed the operator of their suspicions and proceeded to pull up the motor to check the skeg and prop. At this point, the operator moved to the stern to watch. When the operator reached the stern, the transom freeboard was reduced to zero and water started flowing freely over the transom into the boat. The passengers and operator moved forward immediately, but water continued to flow into the boat until the aft half of the boat was swamped. The boat then sank stern first, coming to rest in an upright position with approximately one-third of the bow section above the water line. The occupants were rescued by a Coast Guard vessel within 10 minutes after the accident.

## 1.0 BOAT OCCUPANT DATA

<u>Occupant</u>	<u>Sex</u>	<u>Age</u>	<u>Weight</u>	<u>Swimming Ability</u>	<u>Boating Experience</u>	<u>Formal Boating Instruction</u>	<u>PFDs Worn/Used</u>	
							<u>Before</u>	<u>After</u>
1-Operator	M	24	148 lb (67 kg)	Poor	> 100 hrs	None	No	Yes
2-Passenger	M	21	210 lb (95 kg)	Good	< 25 hrs	None	No	Yes *
3-Passenger	M	22	157 lb (71 kg)	Excellent	> 100 hrs	None	No	Yes **

\* Held to six gallon (23 liter) fuel tank

\*\* Held to metal cooler

### 1.1 Operator

He was suffering from some type of disorder (probably muscular dystrophy) that noticeably affected him physically and mentally. His right hand and wrist were slightly deformed and there seemed to be some muscle deterioration in his right arm. His speech was slurred and sometimes incoherent. He was subject to seizures brought about by emotional stress which impaired his motor responses. He had such a seizure during the early part of the interview, and very little information was obtained from him concerning the accident. According to his brother (Passenger 3), he had owned the boat two years and had used it exclusively for fishing. He always operated the boat, but never went out alone. He was familiar with the waters in the accident area and had a basic knowledge of small boat operating procedures.

### 1.2 Passenger 2

He was a high school graduate and seemed to be of average intelligence and physical ability. He had never owned a boat and was not familiar with small boat operating procedures. He had less than 25 hours operating boats belonging to his friends. He had never operated the involved boat. He was not familiar with the waters in the accident area.

### 1.3 Passenger 3

He was a high school graduate and seemed to be of average intelligence and above average physical ability. He was on leave from the U.S. Air Force at the time of the accident. He seemed to possess at least average knowledge concerning small boat operation. He had operated the involved boat in the accident area numerous times.

## 2.0 ENVIRONMENT

The sky was overcast with an estimated visibility of three miles (4.8 km). The wind was from the east at an estimated velocity of 15 knots. When the boat entered the Gulf the wind was from the east at approximately five knots and the water condition was 1-1.5 ft (0.3-0.5 m) rolling swells. At the time of the accident the wind velocity had increased to approximately 15 knots and the wave heights had increased to 3-4 ft (0.9-1.2 m). The estimated air temperature was 75°F (24°C) and the estimated water temperature was 65°F (18°C).

## 3.0 NARRATIVE DESCRIPTION OF ACCIDENT

### 3.1 Pre-Accident

The day before the accident Passenger 3 set up a fishing trip with his brother, Owner/Operator 1, and a friend, Passenger 2. According to the men, they all received a normal night's sleep, getting up around 0800. No. 1 kept his boat stored in a garage in Clearwater, approximately four miles (6.4 km) away from his home. The men left Nos. 1 and 3's home to get the boat at approximately 0900. They picked up the boat and towed it to a launch ramp on Belleair Beach, arriving at approximately 0945. The fishing gear and a cooler containing soft drinks were loaded aboard and the group departed the ramp at approximately 1000 destined for the north end of Clearwater Bay. They arrived at the Garden Memorial Causeway at approximately 1010 and began drift fishing. They drift fished in various locations in St. Joseph Sound and Clearwater Bay until approximately 1300. The fishing was poor and the men decided to move out in the Gulf to see if fishing was any better. They traveled out Clearwater Pass to a position approximately three miles (4.8 km) off shore. They drift fished in this area until approximately 1600. At this time, No. 3 noticed that the stern was lower than usual and there was water in the aft section of the passenger compartment. Nos. 2 and 3 had been fishing from the stern section and No. 1 had been seated at the helm fishing. No. 3 informed Nos. 1 and 2 that he thought the motor was caught on something causing the stern to be pulled down.

### 3.2 Accident

Gear and people aboard were as shown in Figure 1 and the weather as noted in Section 2.0.

Nos. 2 and 3 looked over the transom but could not see anything caught on the motor. They decided to raise the motor and check the skeg. As they started to raise the motor, No. 1 decided to move aft and watch. When he reached the stern, the weight of the occupants and water in the boat caused the stern to go down to the point that water flowed freely over the transom into the boat. The men were pre-occupied with checking the motor and did not pay particular attention to the ingress of water until there was a considerable amount of water in the aft section of the boat. After finding nothing caught on the skeg, the men moved forward to increase the transom freeboard. Water continued to flow over the transom and the men decided to get underway and siphon the water out through the transom drain. No. 1 attempted to start the motor, but apparently the battery had submerged and shorted so the starter would not operate. No. 3 grabbed an empty bait container and started bailing out the water. Within 30 seconds, the transom completely submerged and the boat started to sink by the stern. As the stern sank, the men got out of the boat over the starboard side. No. 1 managed to grab an AK-1 PFD that was on the port seat. Two other AK-1s that were on the floor amidships were washed up under the bow. The boat continued to sink in an upright position until approximately one-third of the bow section remained above the waterline. No. 2 grabbed a six gallon (22.7 liter) fuel can that had floated out of the boat and No. 3 grabbed an empty cooler.

### 3.3 Post-Accident

The men thought the boat was going to completely sink and immediately decided to start swimming for shore. The visibility was decreasing, they were swimming into the wind, and it would start to get dark in approximately one hour. The men were afraid they would lose sight of the shore and become lost before they could reach safety. After swimming approximately 30 yd (27.4 m) holding to the flotation devices, the men spotted a Coast Guard vessel coming toward them. The vessel was enroute to another location in response to a radio call for assistance. The crew of the rescue vessel spotted the swamped boat and proceeded toward it.

The men in the water attracted the attention of the rescue vessel crew by shouting and waving their arms. The rescue vessel took the men aboard and transported them to a marina in Clearwater. The rescue vessel then returned to the accident scene and towed the swamped boat to the municipal pier in Clearwater. (Refer to Figure 2 for sketch of accident area.)

#### 3.4 Time Sequence of Accident Events

0800	-	Men arose and prepared for trip
0900	-	Departed operator's home for boat storage garage
0945	-	Arrived at ramp and launched boat
1000	-	Departed ramp
1000-1300	-	Drift fished in bay
1300	-	Departed bay toward a fishing spot in Gulf
1315-1600	-	Drift fished in Gulf
1600	-	Discovered water in boat
1601	-	Passengers raised motor to check skeg and operator moved aft to water
1602	-	Men noticed considerable amount of water in aft section of boat and moved forward
1602-1603	-	Boat filled with water and started to sink by the stern
1603	-	Men jumped out over starboard side and started swimming toward shore
1610	-	Coast Guard vessel spotted men and took them aboard

#### 4.0 VESSEL DATA

At the time of the investigation the boat was at a marina for repairs. The marina was closed and the boat could not be examined. The following information was obtained from the BAR and the occupants aboard.

The boat was a fiberglass 1967 Seabreeze semi-V powered by a 1976 85 horsepower Mercury outboard motor. The overall boat length was 16 ft (4.9 m). According to the operator, there was some type of capacity plate installed on the boat but he did not remember any of the stated values.

#### 5.0 PSYCHOLOGICAL AND HUMAN FACTORS

It was apparent from the interview that the owner/operator knew very little about small boat operation. It was also apparent that he was not mentally or physically fit to operate a boat in a responsible manner. It is believed that he was not allowed to go out with the boat without a responsible adult with him. His operating ability is not considered a factor in this accident, but other actions by him prior to the accident are considered contributing factors, such as moving to the rear of the boat when the boat attitude was in a critically stern low position. The passengers seemed to be responsible individuals but were so pre-occupied with checking the motor that they did not realize the transom freeboard had been reduced to zero.

## 6.0 PROBABLE CAUSE OF ACCIDENT

The following items are most likely the major factors in causing this accident:

- Inattention on the part of the occupants is considered the major factor. They permitted the transom freeboard to be reduced to the point that water flowed freely into the boat.
- Deciding to stay out until the water conditions approached the safe operating limits of the boat.

## 7.0 DYNAMICS/ANALYSIS OF ACCIDENT

According to the estimated weight of the people and gear in the boat at the time of the accident, the boat was not overloaded. However, considering the weight of the water that entered the boat during the trip, the maximum weight capacity was most likely exceeded. The passenger weight and water weight in the aft section caused the transom freeboard to be reduced to near zero. When the operator moved aft, his weight was sufficient to reduce the transom freeboard to zero allowing water to flow freely into the boat. By the time the occupants realized that water was flowing into the boat, sufficient water had accumulated in the stern to cause the transom to remain in a low attitude even after the occupants moved forward. Water continued to flow over the transom until the aft section flooded and sank. Entrapped air in the bow section most likely kept the boat afloat in an upright, bow high attitude.

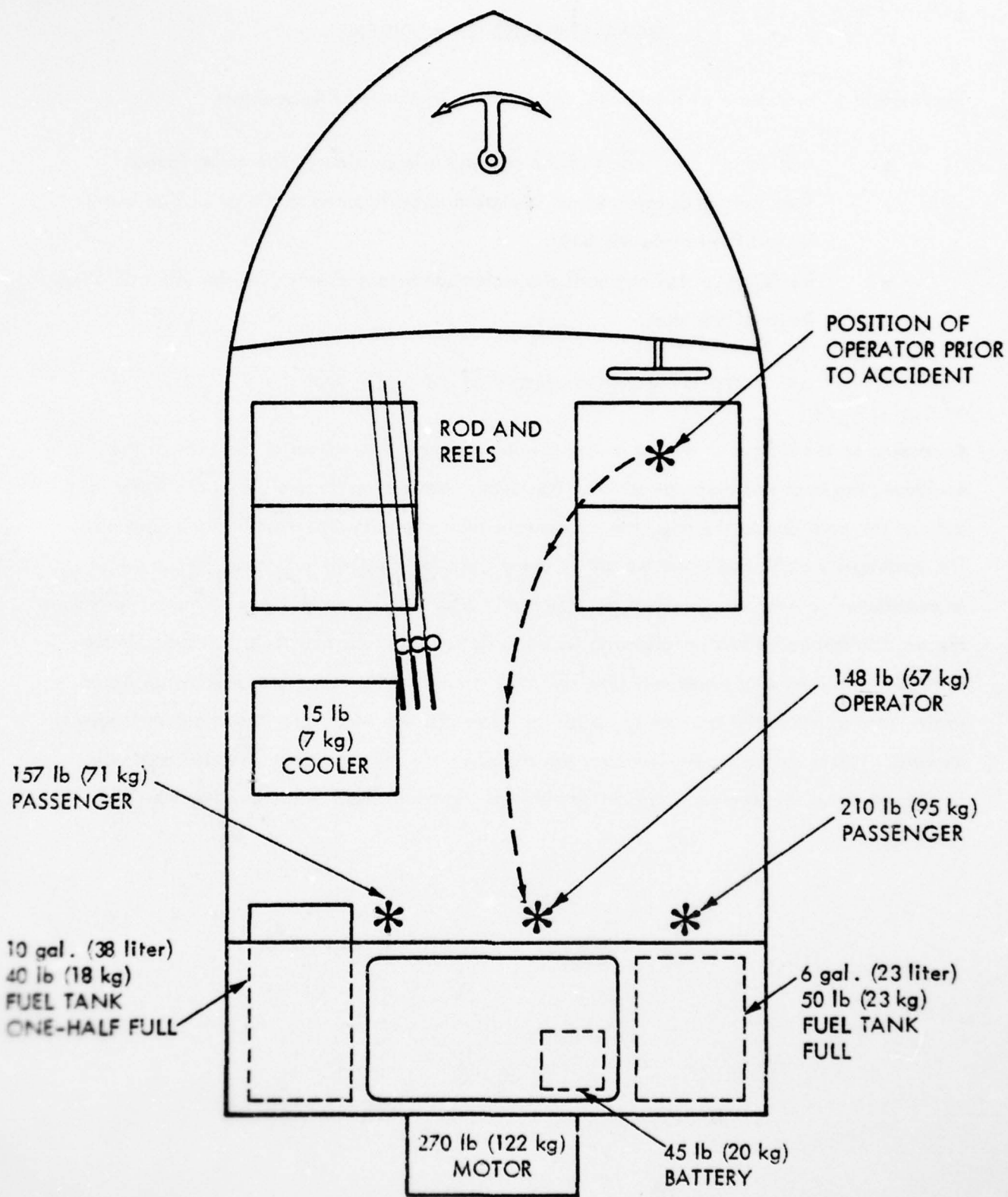


FIGURE 1. BOAT LOAD DISTRIBUTION AT TIME OF ACCIDENT

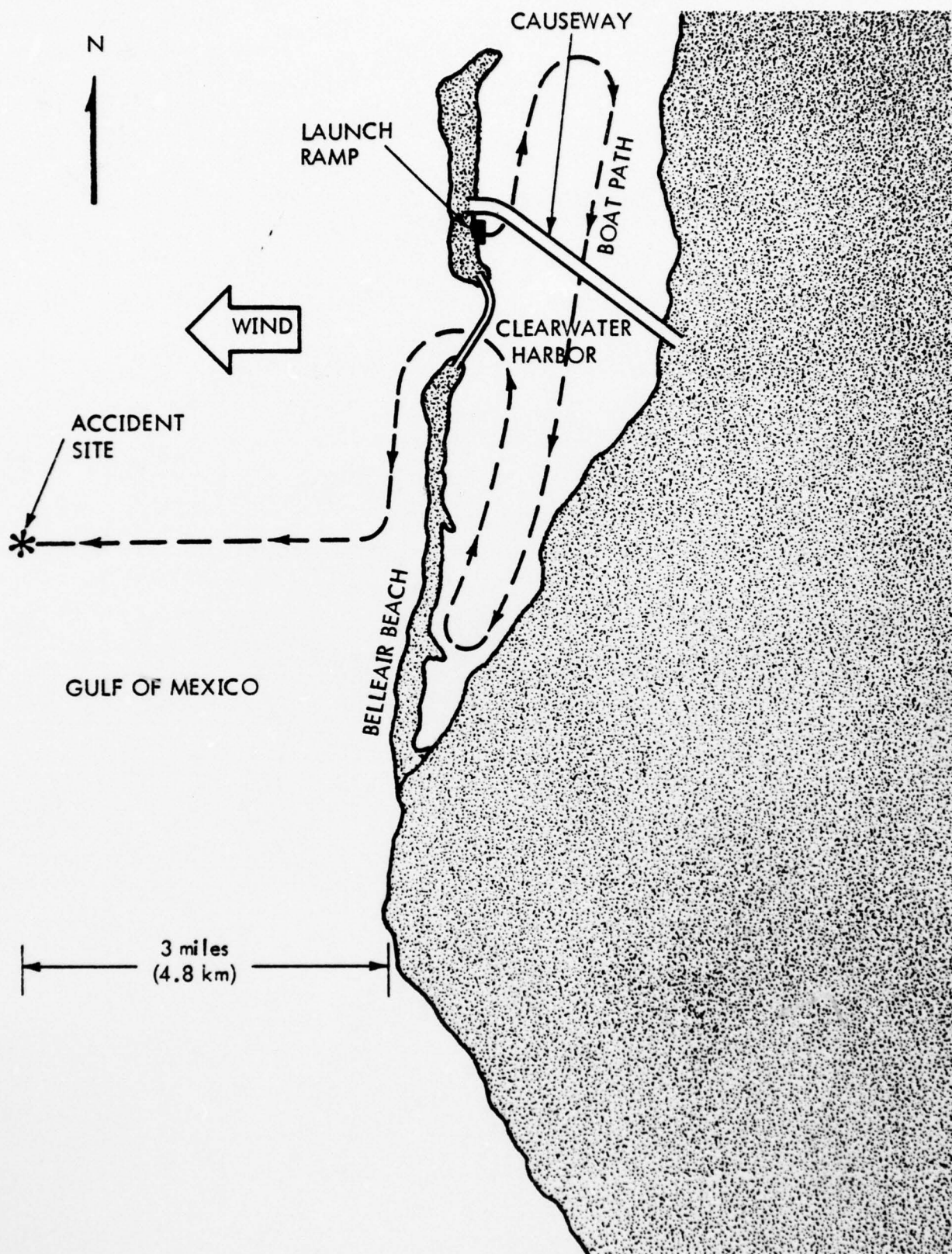


FIGURE 2. SKETCH OF ACCIDENT

BB-9/BB-10

385  
386x  
all